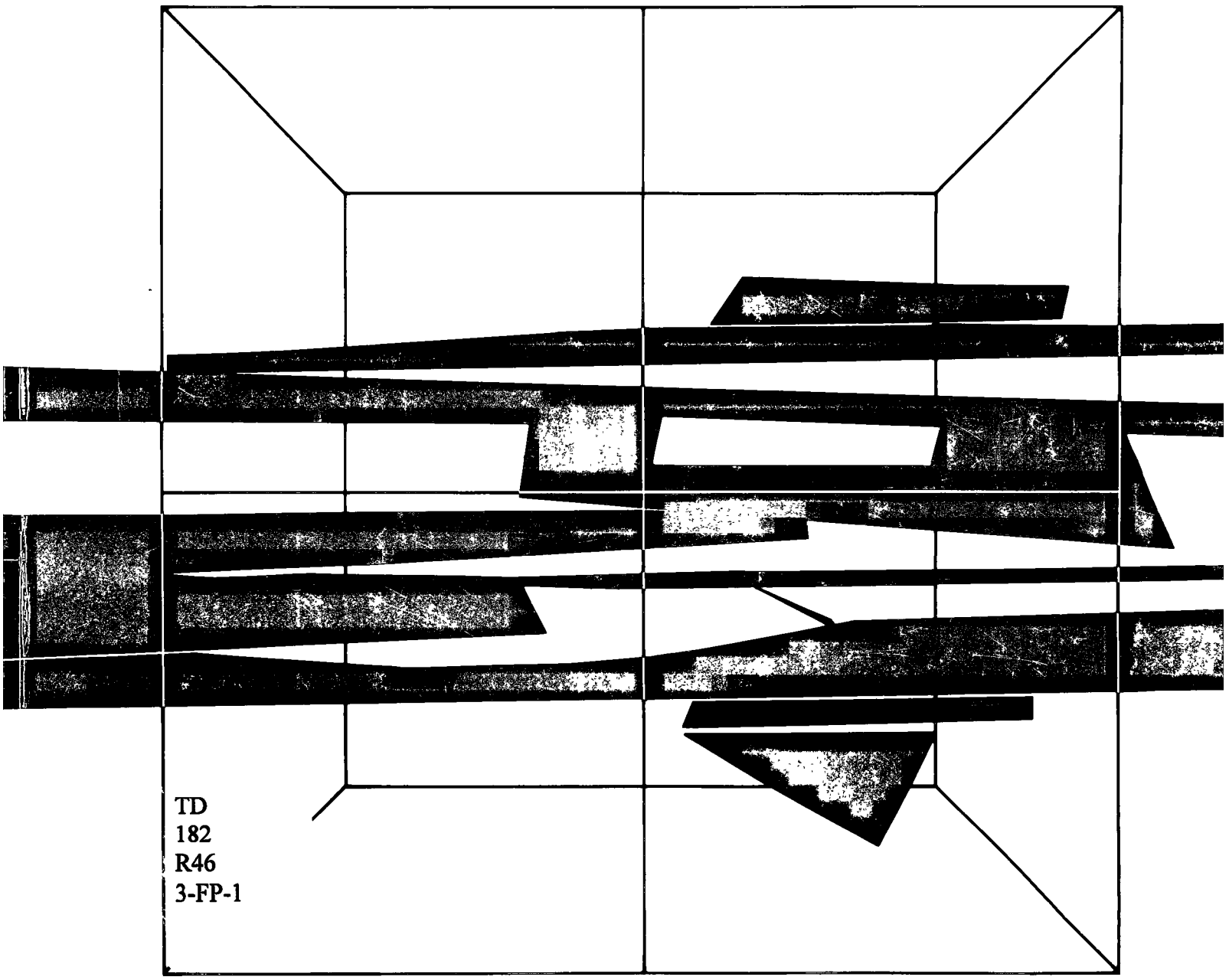
Anaerobic Treatment of Dairy Effluent

Report EPS 3/FP/1
September 1986



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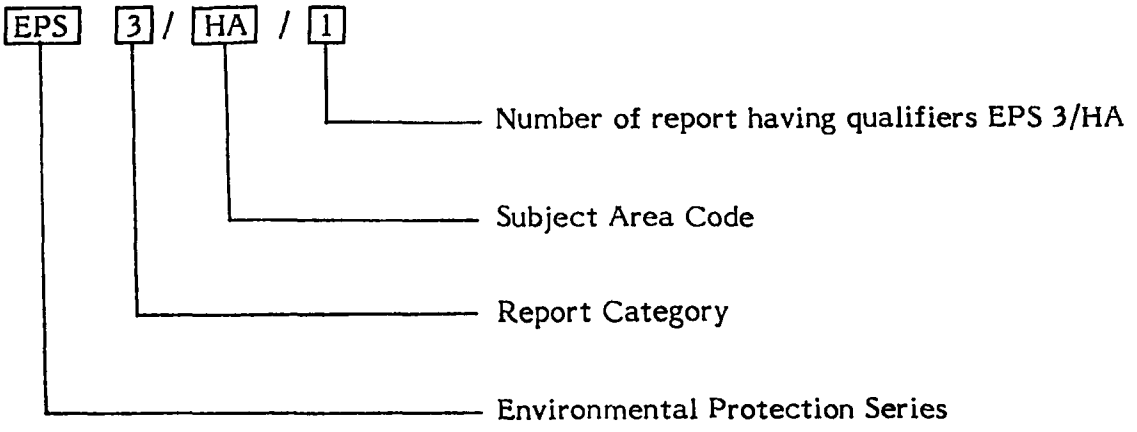

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ANAEROBIC TREATMENT OF DAIRY EFFLUENT

by

BEAK Engineering Ltd.

under contract to:

AGROPUR
Coopérative Agro-Alimentaire

for the

Technology Development and
Technical Services Branch
Environmental Protection
Environment Canada

Report EPS 3/FP/1
September 1986

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G. Hill
Technology Development and
Technical Services Branch
Environment Canada
Ottawa, Ontario
K1A 1C8

Cat. No. En49-17/3-1E
ISBN 0-662-14951-3
BEAUREGARD PRESS LIMITED

ABSTRACT

The performance evaluation of two full-scale anaerobic wastewater treatment systems operating in parallel at a cheese plant is described in this report. The plant is owned by Agropur and is located at Notre-Dame-du-Bon Conseil, Quebec. Partial funding for the treatment system and the two year operating study was provided by Environment Canada's Development and Demonstration of Resource and Energy Conservation Technology (DRECT) Program. Beak Engineering Limited was engaged to complete the performance evaluation.

The first anaerobic process consisted of a downflow reactor which contained three layers of clay blocks with square vertical channels. Equalized and pH controlled wastewater containing a mixture of carbohydrate, volatile acids, proteinaceous material and volatile suspended solids was fed to the reactor at loadings from 20 to 200 percent of the design value based on the initial void volume. The reactor performed well initially, but steadily lost active volume due to solids accumulation. The COD removals decreased from a range of 60 to 80 percent removal after the start-up period to 50 percent and less by the end of the program. Tracer studies indicated that active reactor volume had declined by 80 percent after 2 years operation.

The upflow sludge bed reactor started-up rapidly after the reactor was seeded with acclimated anaerobic sludge from another full-scale sludge bed system. Reactor stability was influenced by rapid changes in COD and volatile acid concentration caused by periodic spills of whey or whole milk. This often caused excessive losses of solids from the sludge bed.

COD concentrations in the 12-hour equalization basin often varied by a factor of 2:1 within a given week because of spills and production variations. Peak variations during major spills were as high as 3:1. Volatile acid concentration followed a similar pattern. Sludge generation rates barely kept pace with sludge solids loss in the reactor effluent resulting in very slow sludge bed growth. The COD removals were between 80 and 90 percent throughout most of the study but loadings were generally only 15 to 25 percent of the design value because of the difficulties associated with developing a sludge bed. The combined effect of high solids carryover in the anaerobically treated effluent and the frequent, large variations in wastewater strength were judged to be the main factors limiting the performance of the upflow anaerobic sludge blanket (UASB).

RÉSUMÉ

Le présent rapport constitue une évaluation de la performance de deux unités de traitement anaérobie des eaux usées d'une fromagerie, exploitées en parallèle et en conditions réelles. L'usine appartient à la coopérative agro-alimentaire Agropur et est située à Notre-Dame-du-Bon-Conseil (Québec). Le système de traitement et l'étude de performance, qui a duré deux ans, ont été financés en partie grâce au programme de Création et de démonstration de techniques de conservation des ressources et de l'énergie d'Environnement Canada (programme DRECT). Pour l'évaluation, on a fait appel aux services de la firme Beak Engineering Limited.

Le premier procédé anaérobie consiste en un réacteur à circulation descendante qui contient trois couches de blocs d'argile parcourues de canaux verticaux carrés. Le réacteur a été alimenté avec des eaux usées égalisées, au pH contrôlé, contenant un mélange d'hydrates de carbone, d'acides volatils, de matières protéiniques et de matières volatiles en suspension, à des charges variant entre 20 et 200 p. 100 de la charge nominale établie en fonction du volume à vide initial. Le réacteur a bien fonctionné au début, mais a graduellement perdu son efficacité par la suite en raison de l'accumulation de matières solides. L'élimination de la DCO est passée de la gamme de 60 à 80 p. 100, pendant la période de démarrage, à 50 p. 100 et moins à la fin du programme. Des études avec traceur ont indiqué que le volume actif du réacteur avait diminué de 80 p. 100 après deux ans.

Le réacteur à lit de boue à circulation ascendante (système UASB) a démarré rapidement après avoir été ensemencé avec de la boue anaérobie acclimatée provenant d'un autre système du même type. La stabilité du réacteur a été influencée par les changements rapides de la DCO et de la teneur en acides volatils causés par des déversements périodiques de petit lait ou de lait entier. Cela a souvent entraîné des pertes excessives des matières solides constituant le lit de boue.

La DCO dans le bassin d'égalisation de 12 heures variait souvent d'un facteur de 2/1 au cours d'une même semaine à cause de ces déversements et des variations dans la production. Les plus grosses variations pendant les déversements importants ont même atteint un rapport de 3/1. La teneur en acides volatils a accusé des variations similaires. La vitesse de production de boue arrivait à peine à compenser la perte en solides dans l'effluent du réacteur et, par conséquent, la croissance du lit s'est avérée très lente. L'élimination de la DCO a varié enre 80 et 90 p. 100 pendant la majeure partie de l'étude, mais les charges traitées ne représentaient généralement que 15 à 25 p. 100 de la valeur nominale étant donné les difficultés associées au développement du lit de boue. Les effets combinés des fortes pertes de matières dans l'effluent traité et des variations fréquentes et importantes dans la concentration des eaux usées ont été jugés les principaux facteurs limitant la performance du réacteur à lit de boue anaérobie à écoulement ascendant.

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1 INTRODUCTION

1.1 Background

Agropur is a major Quebec-based agricultural cooperative specializing in the dairy industry. It produces and markets a complete range of dairy products from over a dozen plants and dairies throughout the province.

Agropur's plant at Notre-Dame-du-Bon Conseil (Bon Conseil) produces cheddar cheese, curd, powdered skim milk and cream by-products. Approximately 1000 tonnes of milk is processed daily with production being relatively consistent year round. Cheese production is based on a 5-day week, 2 shifts per day and milk deliveries, pasteurization and powdered milk production occur daily.

The plant is situated on the east bank of the Nicolet River, which is the receiving water for liquid effluents from the plant. Historically, the effluent discharge consisted of 1500 to 1800 m^3/d of flow, 2000 to 3000 kg/d of 5-day Biological Oxygen Demand (BOD_5), and 4000 to 6000 kg/d of Chemical Oxygen Demand (COD). Several different methods were considered during the mid 1970's for reducing the BOD_5 and COD prior to discharging the effluent to the river. Conventional methods of treating dairy effluent such as activated sludge treatment and aerated stabilization basin treatment were evaluated and rejected for various reasons. These included system complexity and costs associated with disposal of excess sludge for activated sludge treatment and concerns regarding the reliability of treatment efficiencies year round with an aerated basin process. The concentration of BOD_5 in the wastewater was roughly 2000 mg/L and there was concern that Environment Quebec's specific guideline of 60/60 mg/L for BOD_5 and Total Suspended Solids (TSS) for discharge to receiving waters could not be achieved. The high costs of power required for oxygen transfer for aerobic treatment was also of concern.

At this point an effort was made to determine whether anaerobic treatment of the wastewater might offer a reasonable solution to the treatment problem. Anaerobic treatment of food, beverage and agricultural wastes and wastewaters was receiving increased attention in the research and development community during the late 1970's but there was no full-scale anaerobic system treating dairy or cheese plant effluent at the time. Theoretically, a system using anaerobic treatment offered several distinct advantages compared to aerobic treatment including:

1) lower solids/sludge production (80 percent retention);
2) lower total energy consumption (60 to 70 percent retention); and
3) production of methane gas representing a potentially recoverable fuel.

Cooperative research programs and consultations were initiated between Agropur, the National Research Council (NRC) in Ottawa and Environment Canada's Wastewater Technology Centre in Burlington, Ontario. Bench-scale and pilot-scale testing were undertaken with emphasis on fixed-film anaerobic reactor processes developed by NRC. Treatment by the upflow anaerobic sludge blanket (UASB) process was also investigated as several full-scale UASB plants had been commissioned in Europe and the United States to treat food and beverage wastewaters.

The decision to construct a full-scale treatment system at Bon Conseil incorporating anaerobic treatment was made in 1981/82. Partial funding for the facility was received from Environment Canada's Development and Demonstration of Resources and Energy Conservation Technology (DRECT) Program.

Construction was initiated between the spring of 1982 and April 1983 at which time process start-up commenced. This report presents a description of the treatment facilities and describes the start-up, the acclimatization and the performance of the anaerobic processes during the first two years of operation in partial fulfillment of Agropur's contract with DRECT.

1.2 Objectives

The objective of the performance evaluation was to develop a suitable program of daily/weekly monitoring and sampling to permit a full analysis of the start-up phase and of the acclimatized operation at the design loadings. The major issues/parameters to be addressed were:

- COD/BOD_5 removal,
- gas production,
- volatile acid reduction,
- effects of hydraulic and organic load variations,
- process stability,
- operating problems, and
- reactor hydraulics.

2 FACILITY DESCRIPTION AND OPERATION

2.1 Overview of Treatment Process

Figure 1 is a simplified flowsheet of the full treatment process at Bon Conseil. The system was designed to treat 1600 to 2100 m^3/d of process effluent containing an average of 2700 kg/d of BOD_5 and 5500 kg/d of COD. The facility consists of a pump station, screening and grit removal, equalization, pH control, two anaerobic reactors, aerated polishing basins and final settling basins prior to discharge to the Nicolet River.

Effluent is collected in the plant floor drains and enters a pump sump containing three effluent pumps. This pump station operates automatically to pump all of the effluent to the treatment building. Here the flow passes through a rotating, horizontal, cylindrical screen to remove large suspended solids into a drum. The effluent flows through grit collection channels before being stored in a 12-hour (800 m^3 liquid volume) equalization basin containing three 3.9 kW Flygt submersible mixers.

The function of the equalization basin is to smooth the hourly variations in temperature, pH and waste strength before the effluent is treated in the two anaerobic reactors which operate in parallel. A pH measuring and control system activates a screw feeder or a metering pump to allow hydrated lime or hydrochloric acid to be added to the basin as needed to maintain a neutral pH.

There are three centrifugal effluent pumps (2 duty and 1 standby) in the equalization basin to feed the fixed-film anaerobic reactor and the UASB reactor. Each pump is rated for 30 m^3/h at 52 kPa total discharge head. This method of feeding the reactors is partially self regulating as the pumping capacity is very sensitive to total head. As the wastewater flow in the equalization basin decreases, the liquid elevation in the basin will fall. This increases the head differential between the operating liquid elevations in the anaerobic reactors and the equalization basin, which decreases the pumping rate at a given pump setting. Excess wastewater can overflow from the equalization basin to the sump for anaerobically treated effluent whenever it is necessary to stop one or the other of the feed pumps or to feed one of the reactors at a reduced loading.

The fixed-film reactor (F.F.) is a concrete tank 8.5 x 10 x 6.5 m deep containing clay tile media. The normal mode of operation is downflow as effluent is pumped to a plastic header system at the top of the reactor and removed via a second header arrangement at the bottom. A steel fixed gas dome similar to those used for municipal anaerobic sludge digesters creates an air tight seal and collects the gas

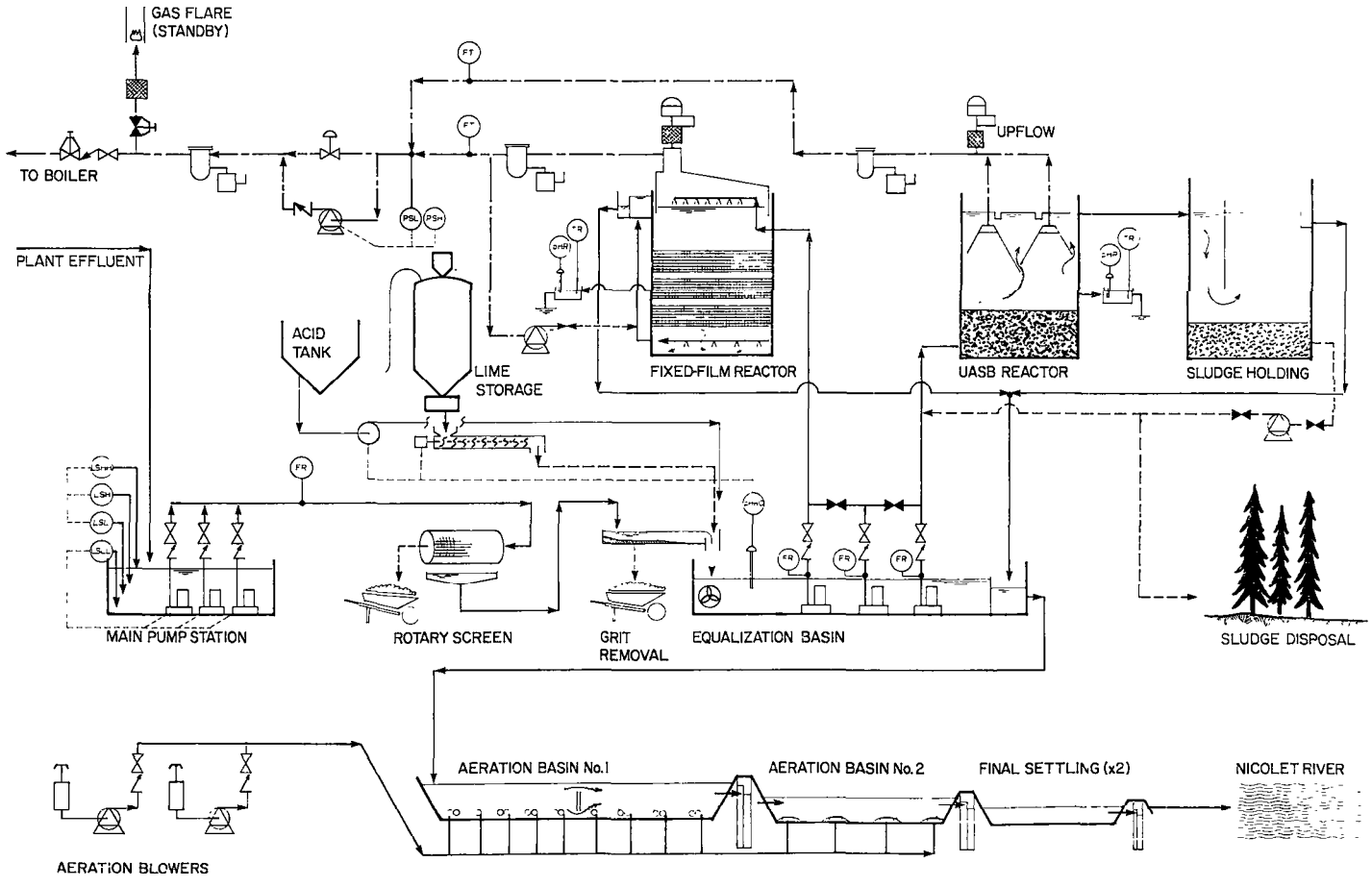


FIGURE 1 EFFLUENT TREATMENT SYSTEM, AGROPUR, BON CONSEIL

produced during anaerobic treatment. The design liquid retention time was 12 hours based on the initial void volume in the packed reactor.

The upflow reactor is also a concrete tank and was designed with a similar total liquid volume and nominal detention time as the fixed-film reactor. The two reactors are independent of one another, operating in parallel. Each was designed to treat half of the effluent flow. The untreated effluent is pumped into a distribution header at the bottom of the UASB reactor, flows slowly upward through a blanket of anaerobic sludge and then overflows into launders which lead to a sludge holding tank.

The sludge holding tank was designed to capture the specially acclimated sludge from the upflow reactor in case of an upset. A reversible sludge pump connects the upflow reactor and the sludge holding tank. In this manner sludge can be returned to the reactor from the holding tank after an upset or excess sludge in the reactor can be removed to storage. If too much sludge is accumulated in the system the sludge pump is available to transfer the excess to a tank truck for land spreading.

Gas produced in the upflow reactor is captured in a submerged gas collector system. The gas from each reactor is metered after removing entrained water, and then the gas streams are combined in a single underground pipeline which leads to the boiler in the plant. There are two gas burner trains, one for the boilers and one for the waste gas burner (which is a standby system to dispose of the gas whenever it cannot be burned in the boiler).

The partially treated effluent leaving the two anaerobic reactors flows by gravity to an overflow chamber at the south corner of the equalization basin under the air compressor room. This overflow chamber is connected by an underground, gravity pipeline to two, aerated polishing basins which are operated in series. Two 30 kW compressors (1 duty, 1 standby) supply air to submerged aeration devices in the basins.

The first basin is divided into two sections by a baffle located approximately one third of the way along the length. Effluent enters the first section (approximately 5000 m^3) which contains five rows each containing 7 Schramm, Aqua Ring$^{T.M.}$ diffusers. The air for each row of diffusers is provided by a PVC lateral pipe which connects with the main air supply header running between the basins.

The second section of the basin (approximately 10 000 m^3) contains 2 rows of 4 diffusers each and 3 rows of 3 diffusers.

The effluent overflows from the first basin into the second basin, which is also aerated and contains four rows of aerators, each row consisting of two star or octopus type clusters of eight diffuser units. Combined hydraulic residence time (HRT) in the two

polishing basins is approximately 17 days. The treated effluent flows through one of two 50-m square final settling basins (1.6 day HRT) before discharging by gravity to an underground pipeline leading to the Nicolet River. The lengthy retention in the polishing basins and the final settling basins was selected in part to allow maximum decay of the suspended solids produced during BOD_5 removal.

2.2 Fixed-film Anaerobic System

The design of the fixed-film reactor was partly based on the NRC investigation of the use of plastic media and clay tiles to provide continuous vertical channels for downflow operation. The downward direction of flow and the continuous channel concept was promoted on the basis that media plugging with biomass would not be a problem.

A total of 19 600 clay blocks were installed in three vertical layers separated by void areas (Figure 1). Each rectangular block was 25 x 25 x 30 cm deep containing the equivalent of 24 vertical holes 4.2 cm^2. The blocks provided a surface area of approximately 1.2 m^2, each giving a total initial packed reactor area of 24 000 m^2 (this includes an allowance for the reactor walls). The total reactor volume (no packing) at the average liquid operating elevation is approximately 550 m^3 providing an initial surface to volume ratio of 44 m^2/m^3. The initial void volume including the packing was 410 m^3.

The fixed-film reactor was operated in a downflow mode during most of the 2-year monitoring period, although the piping was designed to allow either upflow or downflow operation. Effluent is distributed at the top of the reactor through four evenly spaced plastic pipes which run the length of the reactor. The pipes are blocked at the ends and contain a series of drilled holes for effluent distribution. Effluent flows downward through the three layers of tile media to a collection header at the bottom of the reactor. It was originally intended to place the clay tiles such that continuous vertical channels formed an unobstructed path for effluent flow. Unfortunately no easy method could be identified at the time of construction to align and fasten each block in the exact position required. Instead, the blocks were manually layed in as close to the desired alignment as possible.

A constant liquid elevation is maintained in the reactor by an external head control box which is open to atmosphere. Treated effluent flows from the collection piping in a vertical riser to the head box. Effluent overflows a standpipe in the head box and then flows to the treated effluent sump at the end of the equalization tank. The liquid elevation in the head box is the same as the liquid elevation in the reactor plus about 20 cm to allow for a small build-up of pressure in the gas dome. Gas leaves the

steel gas dome under its own pressure, it passes through a moisture accumulator and drip trap assembly and then cumulative flow is recorded by a flowmeter. At this point the gas streams from the two reactors join into a common pipeline which conveys the gas to the plant's boiler. Pressure regulation in the pipeline is provided by a manual control valve operating in parallel with a blower.

A gas recirculation compressor rated at 5 Nm^3/min (normal cubic metres per minute) was installed to allow gas scouring of the media periodically to help clear the downflow channels should excessive accumulation of biomass cause plugging. The compressor can recirculate gas to the bottom of the reactor through a second plastic header system. The blower provides approximately ten times the gas flow generated in the reactor at the design loading.

The fixed-film system was designed to treat half of the total effluent load. This can be expressed as a COD load of 5 kg/m^3 of empty reactor volume per day or 6.7 kg/m^3 of initial void volume. The liquid retention is 16 hours based on empty reactor volume or 12 hours based on the initial void volume of the packed reactor.

2.3 Upflow Anaerobic Sludge Blanket System

The second anaerobic reactor (7 x 10 x 5.9 m deep) was designed as a UASB system because of its increasing popularity for use at full-scale for effluents from the food and beverage industry. The physical design also allows either reactor to be retrofitted to the other in the event that one process is found to be superior.

The piping systems at the bottom of both reactors are similar. The flow in the UASB is upward and the bottom effluent header is used to distribute the equalized wastewater within the reactor. The bottom two thirds of the reactor is "void" volume. Here, the heavy, granular sludge typical of UASB systems is allowed to accumulate in a deep sludge blanket where virtually all of the anaerobic treatment occurs. The proper development of a dense sludge is critical to the UASB operation. The gas evolved during anaerobic degradation creates a bouyancy which carries any light suspended solids present upward toward the effluent launders. It would be impossible to maintain a viable anaerobic sludge in the system if flotation of the microorganisms were the dominant hydraulic phenomenon in the system.

A proprietary design for a system to separate the gas from the treated effluent at the top of the reactor was purchased from EUROCONSULT in Arnhem, The Netherlands. The system consists of a series of submerged gas collection domes and a surface effluent launder system as shown schematically in Figure 1. A few centimetres of

static pressure are allowed to build up in the top of the gas hoods by regulating the outflow of gas with the pressure control system. In this manner the gas is separated from the liquid before reaching the surface which allows the effluent launder system to be open to atmosphere. The top of the tank is enclosed with galvanized roofing panels to protect the reactor from the weather and to minimize the dissipation of possible odours.

Effluent flows from the UASB reactor to a 200 m^3 quiescent sludge holding tank (3.5 x 10 x 5.5 m deep). Wastewater at the influent end flows under a baffle into the main section of the tank and then into a short effluent launder at the far end of the tank. This leads to the treated effluent sump where the flows from the two reactors combine. The purpose of the holding tank is to store excess granular sludge as a reserve against loss of the active sludge bed from a toxic shock or some other phenomenon. It is also intended to help retain anaerobic sludge which may be lost from the anaerobic reactor by flotation with gas bubbles. It was thought that relatively little turbulence would be present from gas evolution in the sludge tank therefore providing an opportunity for floated sludge to resettle. The reactor and the holding tank are connected by a peristaltic-type reversible sludge pump so that sludge can be pumped in either direction. Sludge can also be pumped to a tanker fill line when sludge accumulation becomes excessive and requires disposal by land spreading. The total liquid volume in the UASB reactor is roughly 413 m^3 which provides 12 hours of hydraulic retention and a COD loading of 6.7 $kg/m^3 \cdot d$ at the design wastewater load. This reactor has continuous temperature and pH monitoring similar to the fixed-film process.

A summary of the design effluent characteristics and process design parameters for the total system is provided in Appendix 1.

3 START-UP AND OPERATION

3.1 Wastewater Characteristics

The untreated wastewater characteristics at Bon Conseil are summarized in Table 1. Some of the parameters were monitored almost daily throughout the period of the performance evaluation and the mean values cited in the table were based on the period between April 1984 to the end of November 1984. These parameters include COD's, alkalinity, suspended solids, volatile acids, pH and temperature. Analyses for Total Kjeldahl Nitrogen (TKN), Ammonia Nitrogen (NH_3-N) and fats were based on 40 to 50 individual analyses conducted between December 1983 and February 1984.

TABLE 1 WASTEWATER CHARACTERISTICS (Measured in Equalization Basin)

Parameter		Mean Value*
COD	total	3390
	filterable	1970
BOD_5	total	1900
Suspended Solids	total	850
	volatile	760
Volatile Acids		890
Alkalinity		1290
Nitrogen	TKN	130
	NH_3-N	30
Fats	total	290
pH	average	6.7
	range	4.5 to 11
Temperature	summer	36°C
	winter	30°C

* in mg/L, unless otherwise indicated

Analyses for BOD_5 were not completed as part of the routine test program. The mean BOD_5 concentration of 1900 mg/L shown in Table 1 was calculated using a BOD_5:COD ratio of 0.56 which was developed as shown in Figure 2. The results for a series of samples analyzed by the Quebec Ministry of the Environment are compared in Figure 2. This ratio is in close agreement with the BOD_5:COD ratio of 0.5 assumed for

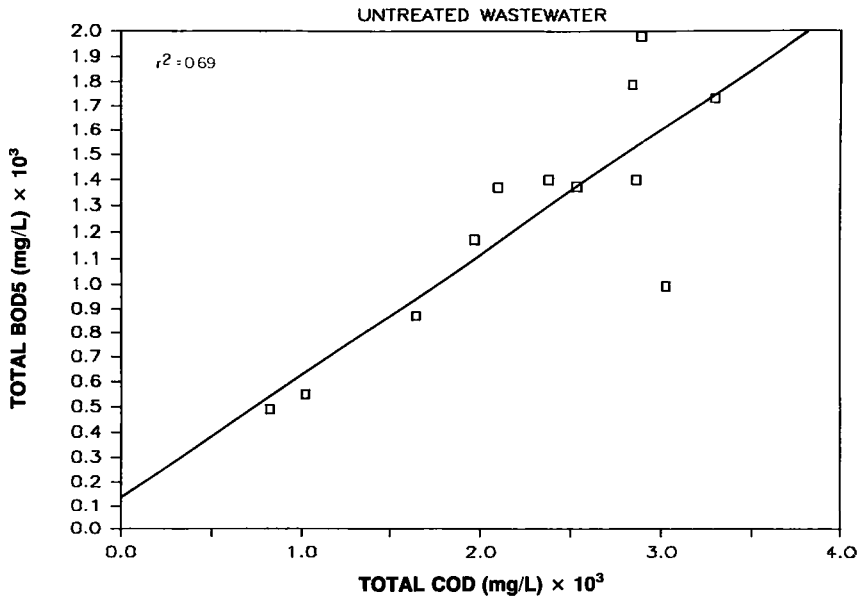


FIGURE 2 TOTAL BOD_5 VERSUS TOTAL COD IN UNTREATED WASTEWATER

design which was available from earlier pilot plant studies.

All of the untreated wastewater analyses refer to the contents of the equalization basin so that the effect of hydrolysis and acidification reactions occurring during the 12 hour retention in the basin are reflected in the data. The composition of the COD in the wastewater can be divided into four general categories:

1) Protein and Amino Acids,
2) Carbohydrates,
3) Fats, and
4) Volatile Acids.

Knowing the relative split among these components is useful as a measure of the ease of COD conversion to methane. Volatile acids are immediately available for methane conversion and often represent the by-products of the first two stages of anaerobic treatment which are bacterial hydrolysis and acetogenesis of more complex molecules.

The volatile acid concentration in Table 1 is 890 mg/L which accounts for 45 percent of the filterable COD in the wastewater. This represents a relatively high degree of hydrolysis. The COD equivalents of the protein, fat, volatile acid and carbohydrate fractions of the wastewater were estimated and are shown in Table 2.

TABLE 2 ESTIMATED BREAKDOWN OF COD COMPONENTS

Component	COD Equivalent (percent of total COD)
Protein and Amino Acids	33
Carbohydrate	15
Fats	24
Volatile Acids	28
TOTAL	100

The volatile acids and carbohydrate fractions account for 43 percent of the total COD. This is the easiest fraction of the COD to convert to methane assuming the carbohydrate is mainly in the filterable fraction. Protein losses to the wastewater originate from the whole milk processing operations in the plant and account for one third of the total COD. The average ratio of TKN to NH_3-N in the wastewater was 4.3:1 which suggests that some protein hydrolysis to volatile acids had taken place in the equalization tank and that the total contribution of protein to the effluent at source in the plant was 40 percent or more.

The protein fraction of the wastewater COD must be completely hydrolyzed through amino acids to acetate before being converted to methane.

The fats represent the COD fraction which is the slowest to degrade. The theoretical design HRT of 12 hours for each of the anaerobic reactors was not expected to be sufficient for efficient anaerobic conversion of this material.

The concentrations of total COD varied on a daily basis within a relatively consistent range between 2500 and 4500 mg/L. Weekend concentrations were similar to concentrations during week days even with the cheese plant not operating. In fact, some of the highest concentrations for a given week were often measured on Sundays.

Spills of whole milk or whey represented the exception to the normal concentration variation. Several significant spills occurred during the program which

increased the total COD in the equalization tank temporarily to concentrations of 6000 to 10 000 mg/L.

Effluent temperatures entering the reactors varied little during the year. Generally, the summer and winter values were 36°C and 30°C respectively (Table 1). Heat losses from the system were minimal because of the relatively short total system HRT and because the equalization tank and a significant portion of the reactor tanks were constructed below grade. Temperature loss through the reactors averaged only 1°C in winter and zero in summer.

3.2 Start-up of Fixed-film Reactor

The fixed-film reactor started operation in mid April, 1983. The reactor was filled with wastewater and then seeded with sludge from a municipal anaerobic digester. The wastewater feed pump was started within several days although it was operated for only a few hours each day at first to avoid too sudden an increase in loading.

The start-up period for the process extended from April almost to the end of December during which time hydraulic and organic loading was gradually increased toward the design values. Detailed operating and performance records were kept from initial start-up to the end of August, sampling was then discontinued for approximately 3 months to focus effort on several system modifications.

Hydraulic and COD loads reached approximately 50 percent of the design values after two months of operation while filterable and total COD removal varied between 40 and 50 percent and 30 and 50 percent respectively. Variations in the pH of the influent wastewater during this period caused periodic disruptions as either shock loads to the reactor or cessation of flow until the pH had been brought under control. The rate of reactor acclimatization was affected by these problems although there was much less direct evidence of this than with the UASB reactor.

Some of the acclimatized granular anaerobic sludge from the UASB (sludge imported from an operating plant in Holland) was transferred to the fixed-film reactor at the beginning of August. Loading was reduced to about 15 percent of design initially and then was increased gradually during the following 4 months. Monitoring continued to the end of August which showed an immediate improvement in treatment efficiency. The COD removal (total and filterable) averaged 80 to 90 percent, average gas production was 0.37 m^3 gas/kg, COD removed and volatile acid concentrations in the reactor effluent decreased to between 50 and 70 mg/L between the 8th and 28th of August when sampling

was discontinued. Measurement of daily flow, temperature, pH and gas production continued between September and November.

Sampling was resumed for a week starting on November 28th by which time the hydraulic loading was 718 m^3/d (90 percent of design) and the total COD load was 4.7 $kg/m^3 \cdot d$ based on empty reactor volume (6.3 $kg/m^3 \cdot d$ on initial void basis). Percent removals for filterable and total COD were 67 and 72 percent for the week respectively. The daily and weekly operating and performance data collected for the fixed-film reactor from start-up to November, 1984 are tabulated in two sets of data sheets in Appendix 2.

3.3 Start-up of UASB Reactor

Seed sludge (113 m^3) shipped from a full-scale UASB system in Holland was added to the sludge blanket reactor during the second week of May, 1983. This established an initial sludge bed height of 1.6 m which would generally be considered as adequate for a rapid system start-up.

Daily feeding of equalized wastewater commenced May 16th and increased to approximately 400 m^3/d (50 percent of the design load) within three weeks, at which time pumping to the reactor was continuous and relatively steady.

The equalization basin was overflowing to the aerated basins continuously during the entire start-up period as the reactors were not treating the full design flow. This maintained a steady total head on the feed pumps. Variations in daily flows occurred only when debris occasionally blocked the feed line at the flow meter or flow control valve, or if the pumps were shut down intentionally.

The COD removals were 80 to 90 percent by late June and early July and the volatile acid concentration in the effluent was low, varying between 70 and 100 mg/L. Measured gas production was unreliable because there was gas leaking from some of the collector hoods.

Reactor operation was disrupted by pH variations in the equalization tank during start-up similar to the fixed-film reactor. It was soon apparent that the UASB system was more sensitive to variations in feed pH as there was often a significant loss of bed solids. The pH control system seemed unable to maintain a relatively steady pH in the equalization basin as designed. Interlocks were added to stop the reactor feed pump if pH in the basin was below 6 or above 9, as a safeguard against further loss of bed solids. This caused unsteady operation of the UASB because the pump would frequently shut down during the evening when there was no supervision.

A decision was made at the end of August to shut down the sludge bed reactor for several months while changes were made in effluent pretreatment. The reactor was restarted in November but the changes to the pH control in the equalization basin were not fully completed until March, 1984. Periodic spills of whey or whole milk continued to cause upsets in the reactor often requiring shutting down the process for several days. For example, 300 m^3 of whey were spilled in the plant on December 19th which caused a three fold increase in the COD in the equalization tank (to 10 400 mg/L). The rate of formation of volatile acids in the equalization tank increased, effectively doubling the normal concentration (to 1700 mg/L) which depressed the pH to 4.7. Brief exposure of the UASB sludge to these conditions caused the sludge to rise and leave the system. The feed was shut off for two days to restabilize and settle sludge which had been carried over in the effluent to the sludge holding tank. The sludge could then be pumped back into the reactor.

The whey spill on December 19th was one of the largest recorded during the performance evaluation, but there were many others with varying effects. Effective pH control in the equalization basin was maintained consistently from the first week of March, 1984 to the end of the program so that direct pH upsets on the sludge blanket system should not have been a problem. The performance and operating records in Appendix 3 for August 30th show a typical example of a whey spill. The lime feed system operated for 95 minutes on August 30th and 31st, the COD concentration in the basin increased from 3000 to 4500 mg/L and the volatile acid concentration increased by 400 mg/L to 1280 mg/L. Most of the reactor operating data showed no sign of any influence from the spill. Concentrations of volatile acids and filterable COD remained steady indicating a high treatment efficiency with little variation in reactor pH. This was not the case with the effluent suspended solids. The TSS concentration leaving the system on August 20th was 818 mg/L which was four times greater than the average for the preceding three days and significantly higher than the generation rate of anaerobic sludge. The effluent solids had a high ash content of 42 percent which was more typical of the granular sludge. Loadings to the UASB were kept low for this reason. For the purpose of this study the start-up period was considered to be complete by early March, 1984. Performance was relatively steady, the reactor operated continuously, and pH control in the reactor feed was effective from March to the end of the program even though loadings were less than the design values. The operating and performance data collected during start-up and the post start-up evaluation are included in Appendix 3.

3.4 Pretreatment and Equalization

Four problems were identified that were associated with plant operations and the pretreatment facilities:

1) excessive sand/grit in the wastewater;
2) periodic high pH from dump of caustic wash waters;
3) the inability of original pH control systems to respond to spills; and
4) spills of whey or whole milk.

Shortly after start-up it was noticed that excessive amounts of sand were accumulating in the grit removal trough creating extra work for the operator and risking sand carryover to the equalization basin. Most of the grit came from the floor drains in the truck unloading area of the plant. The problem at the treatment plant was solved by installing sand traps in the floor drains and cleaning them daily. A second grit channel was also added downstream of the rotary screen.

The evaporators in the plant are cleaned regularly using a caustic wash, usually during the late evening. Normal practise was to dump the spent caustic wash directly into the sewer. This was monitored occasionally as an increase in pH in the equalization basin. A holding tank was installed in the process area to collect all of the caustic wash during each cleaning cycle. This is emptied to the floor drains for several hours by a bubbler type level indicator and a control valve at the bottom of the tank. No more upsets were attributed to caustic dumps and high pH in the basin.

The original pH control system consisted of small indoor tanks with caustic soda and phosphoric acid. It was confirmed shortly into the start-up program that continuous caustic and acid addition was not necessary to maintain a pH between 6 and 7 in the basin. During spills or upsets in the plant, however, the volume of caustic available in the tank was often insufficient to satisfy the instantaneous buffering needs. This was the main cause for unreliable pH control between April, 1983 and February, 1984.

The small acid and caustic tanks were replaced by larger outdoor storage facilities. The caustic facility was replaced by a silo and screw feeder system for hydrated lime. The pattern of lime use after the new system was completed in March, 1984 was very consistent. The process would operate for days or weeks without any requirement for lime between spills which would then cause 50 to 100 minutes of screw feeder operation during a relatively short period. This was a large improvement compared to the original system and was generally thought to have solved the pH control problem.

Spills of whey causing rapid changes in the concentration of COD and volatile acids in the equalization tank continued to cause operating difficulties for the UASB reactor as previously mentioned. This was not the case for the fixed-film reactor. Efforts were made to decrease the frequency and duration of spills by improved vigilance in the plant but it was not possible to eliminate spills entirely.

3.5 Fat Accumulation

Problems with fat accumulation in the system were first noticed in January, 1984 when the reactor hoods and gas domes were opened and inspected. A layer of fat was found trapped at the gas/liquid interface at the top of the gas hoods in the UASB reactor and a similar accumulation was found on the liquid surface in the fixed-film reactor. Neither reactor was designed to remove fats or other floating debris from these areas.

The depth of fat accumulation at the surface of the fixed-film reactor was measured to be 5 to 7 cm on January 16, 1984. Cumulative loading records from initial start-up to this date were used to estimate a total load of 300 000 kg of COD to the reactor. The total fat load can be estimated from the wastewater characteristics in Table 1 to be 25 000 kg or 28 m^3 during the same period. The observed accumulation was 4 to 7 m^3 showing that a significant percentage of the total load had been trapped in the reactor and had not degraded. A build-up of between 16 and 24 cm of fat annually would be expected when the reactor is operating at the design loading. Work is currently underway to recover the first rinse from milk processing in the plant which should minimize fat losses in the future.

3.6 Gas Storage and Delivery

Initial attempts to burn the gas in the plant boiler were unsuccessful. The gas was delivered under its own pressure from the gas dome and gas hoods, through the accumulators and gas meters and then underground approximately 250 m to the boiler. It was difficult to maintain consistent burner operation because of variations in gas supply/pressure at the burner control valve. The burner train shut down and the gas by-passed to the flare any time the control system detected under pressure in the line. The gas hoods provide almost no storage while storage in the gas dome is in the order of 200 m^3.

The design of the gas burner train did not allow for automatic re-firing once the gas had diverted to the flare. Eventually a small gas blower was installed in the

delivery line at the treatment plant. The blower operates in parallel with a manually throttled control value. The valve is throttled to allow backpressure to build up in the line and the blower is activated by a pressure switch when the maximum pressure (approximately 300 mm of water) is reached. This shuts down on a signal from a low pressure switch when the blower has reduced the gas inventory to give a back pressure of 100 to 120 mm of water. This system works reasonably well and gas burner operation has been relatively consistent since the change was made.

3.7 Odour Control

Exhaust ventilation from the covered equalization tank and from the gas space above the UASB reactor was the source of strong, disagreeable odours especially during warm weather. A peat bed scrubber was installed in 1984 to control the odour by removing reduced sulphur compounds from the gases. The scrubber consists of a shallow, square concrete basin approximately 5 x 5 x 1.5 m deep. A plastic distribution header was installed at the bottom of the basin over which is placed a metre or more of loose peat mixed with branches to prevent compacting. The exhaust gases are forced vertically through the bed which is always kept moist by the humidity in the gases. Otherwise the bed would have to be wetted occasionally. This type of peat or compost scrubber is similar to systems used for some types of anaerobic treatment systems in Europe. Virtually no odours have been detected since the scrubber was commissioned.

3.8 Corrosion

The gas space above the liquid in the UASB reactor is not a sealed gas reservoir and is open to atmosphere through the roofing panels. Minor amounts of anaerobic gas containing methane, carbon dioxide and traces of hydrogen sulphide are also released into this space by the effluent. This, together with the high temperature and humidity, causes a very corrosive environment. The metal support framing for the roof decking and the galvanized deck panels have deteriorated from corrosion during the first two years of operation. The panels will be replaced shortly with FRP panels or with some other material not prone to corrosion.

4 PERFORMANCE EVALUATION

4.1 General Performance Summary

4.1.1 Fixed-film Reactor. The test period after start-up for the fixed-film reactor consisted of three phases. In Phase 1, the loading to the reactor was held at 4.0 to 4.5 kg COD/m^3·d. In Phase 2, the loading was increased to approximately 7 kg COD/m^3·d. Phase 3 was characterized by a variable loading ranging between 2 and 6 kg COD/m^3·d. The cumulative reactor loading and effluent total COD are given in Figure 3 and weekly average values are presented in Figure 4. Variation in the effluent total COD mirrored the changes in loading experienced by the reactor. Similarly, both cumulative gas production (Figure 5) and weekly average gas production (Figure 6) reflect the variation in loading.

The apparent relationship between COD loading and COD in the treated effluent seen in Figure 4 was examined further in Figure 7 by plotting the total COD in the effluent (kg/d) against total COD loading (kg/m^3·d). The volume basis for the loading data was taken as the total empty reactor volume or 550 m^3, although it was recognized that the total initial void volume available for wastewater treatment was 410 m^3. The effluent data were shown to be dependent on the loading based upon the results of a least squares analysis presented in the figure. The correlation coefficient of 0.85 (r^2 = 0.73) suggests that there remains some lack of fit not explained by the linear regression equation.

Average COD removal was about 60 percent as indicated in Figure 8. The linear regression of removal as a function of loading would tend to indicate reduced percentage removal at the higher loadings. However, the high scatter at the lower loadings, the small negative slope of the regression line, and the low correlation coefficient of 0.35 (r^2 = 0.12) cast doubt on this hypothesis.

Most of the COD removals above 60 percent occurred during the Phase 1 testing which ended in early July 1984. During this period reactor operation was very stable with pH generally between 6.9 and 7.2 and alkalinities in a range between 1200 and 1500 mg/L. Volatile acid concentrations in the reactor effluent were also relatively low and consistent between 50 and 100 mg/L. The lower percent removals were generally associated with the high loading conditions in Phase 2 and with the final Phase 3 period between September and November, 1984.

As gas production seemed to follow the variation in loading, weekly average gas production was plotted against reactor loading in Figure 9 and a significant

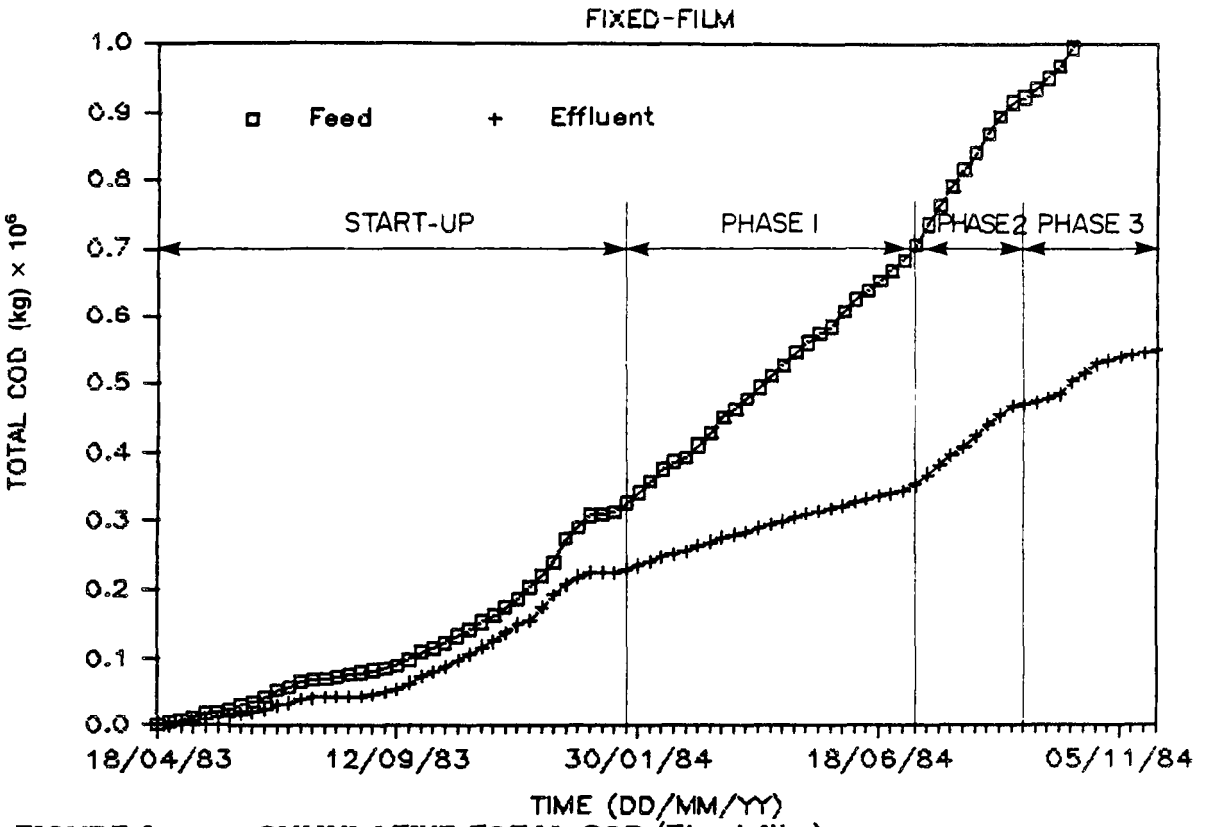


FIGURE 3 CUMULATIVE TOTAL COD (Fixed-film)

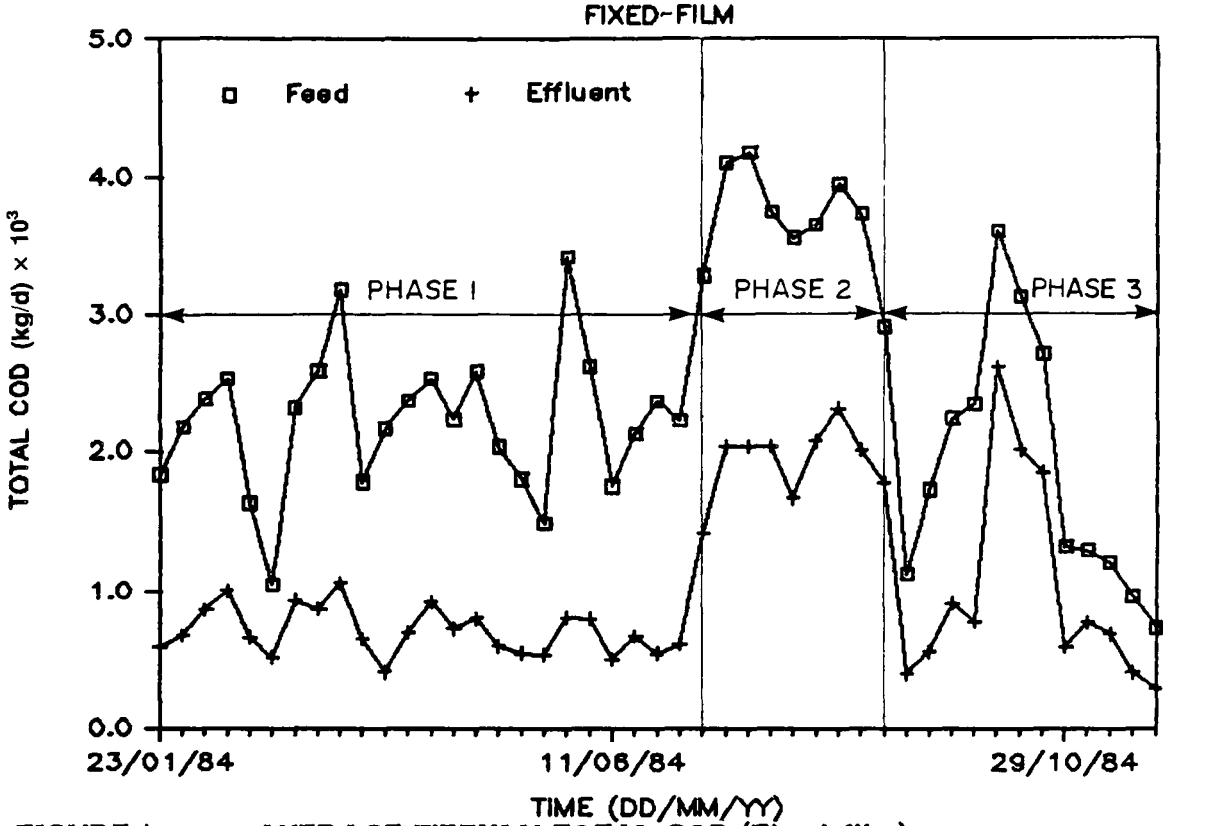


FIGURE 4 AVERAGE WEEKLY TOTAL COD (Fixed-film)

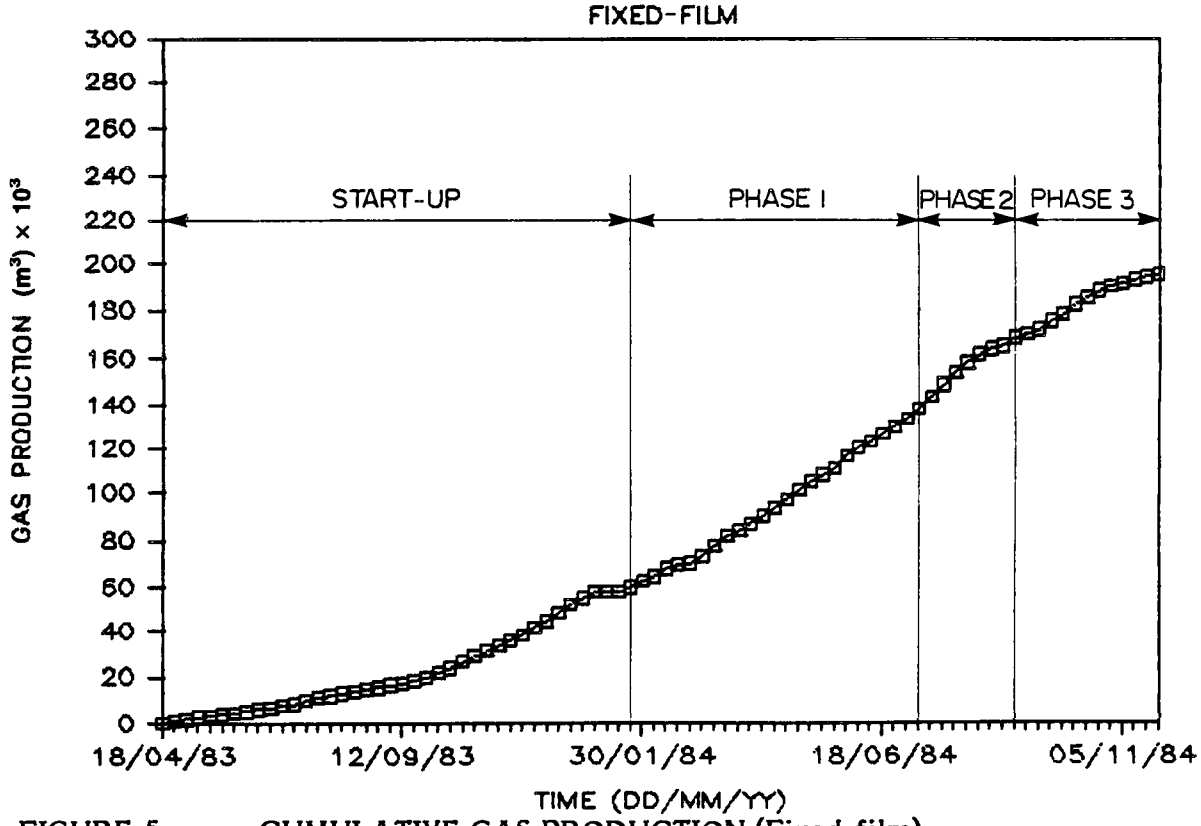


FIGURE 5 CUMULATIVE GAS PRODUCTION (Fixed-film)

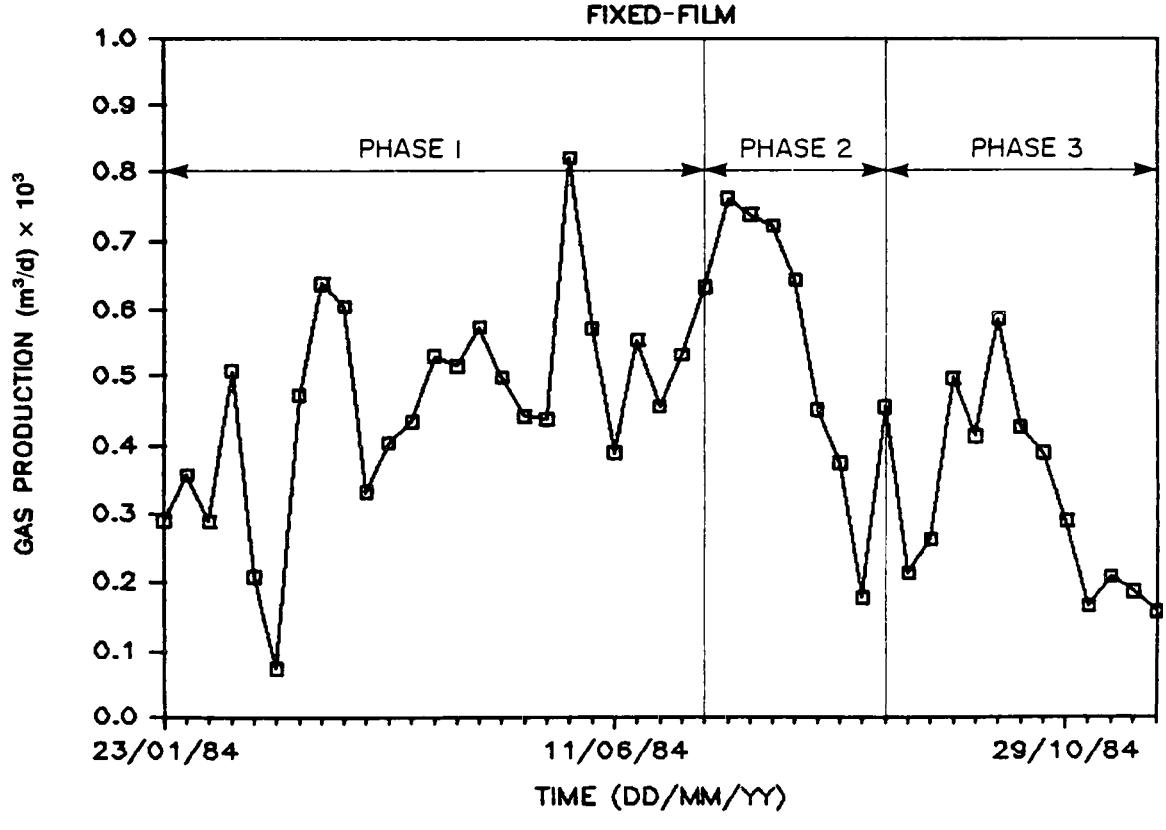


FIGURE 6 AVERAGE WEEKLY GAS PRODUCTION (Fixed-film)

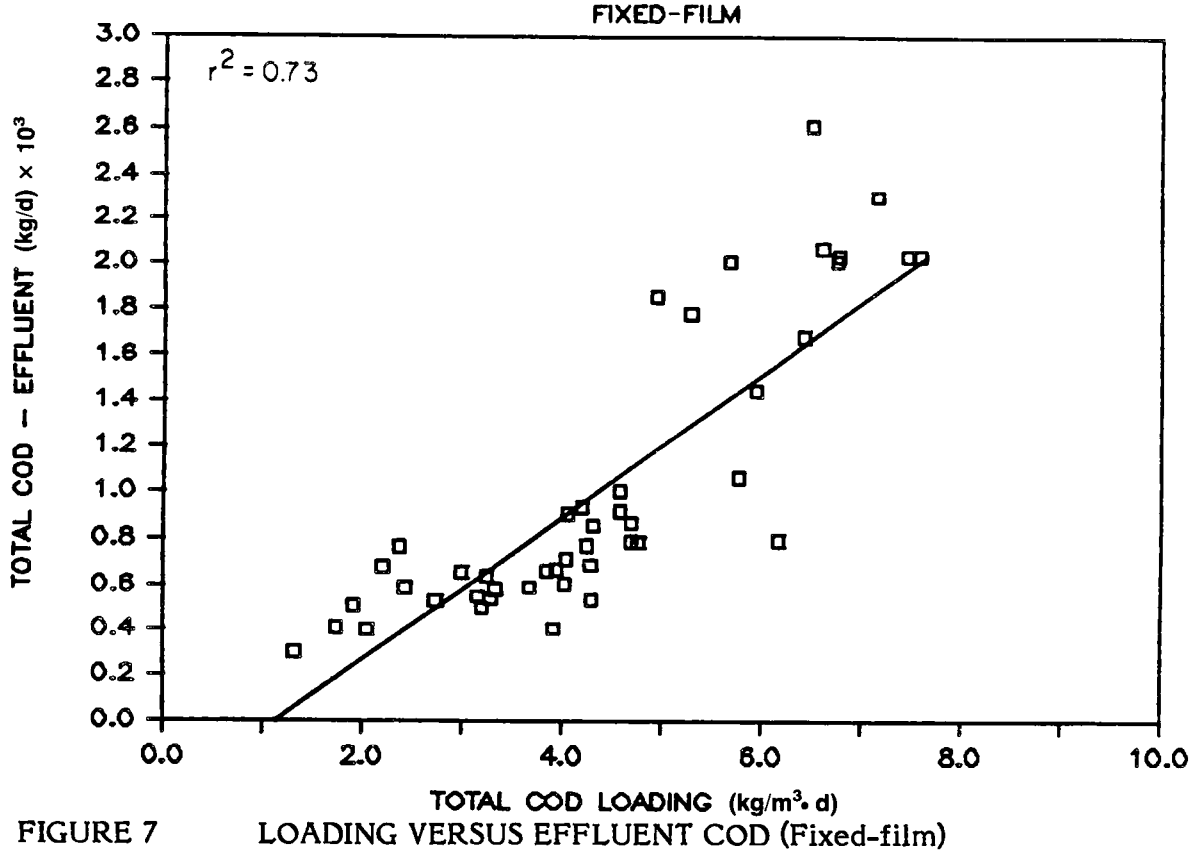


FIGURE 7 LOADING VERSUS EFFLUENT COD (Fixed-film)

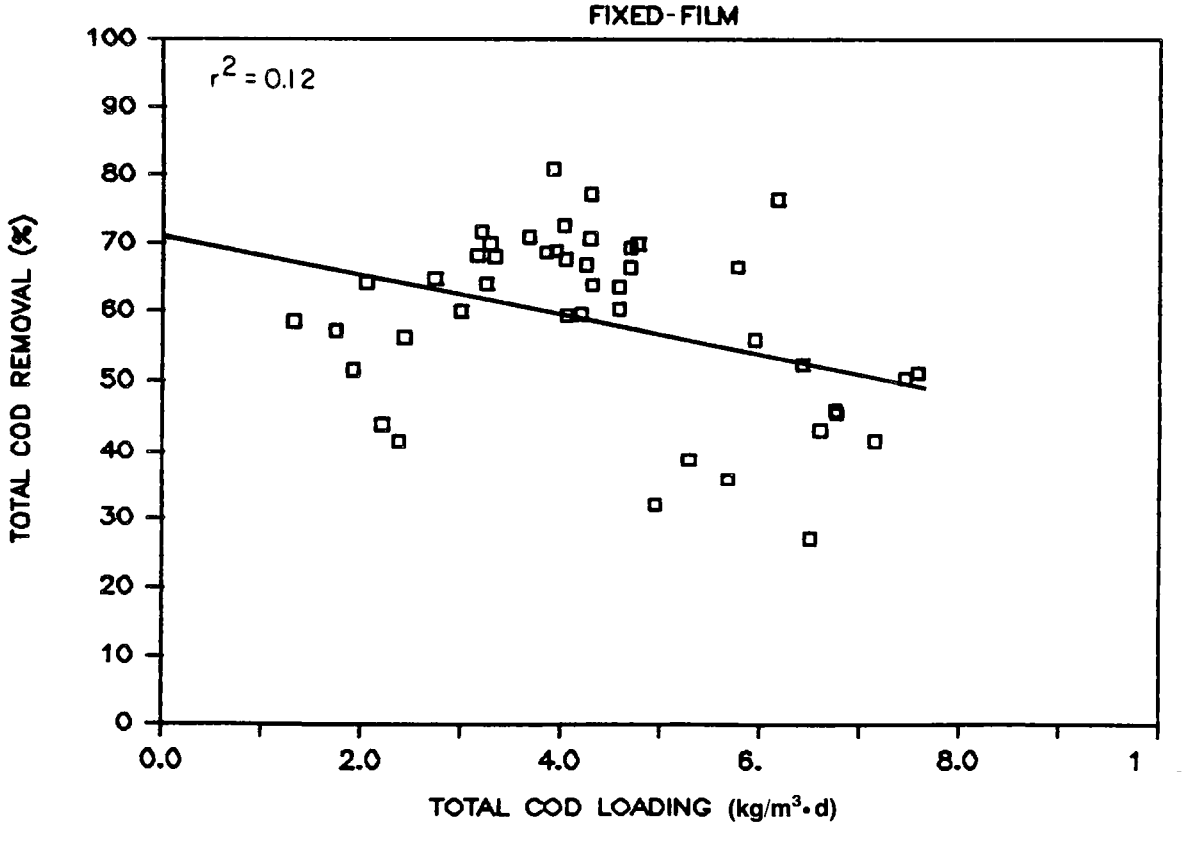


FIGURE 8 LOADING VERSUS REMOVAL EFFICIENCY (Fixed-film)

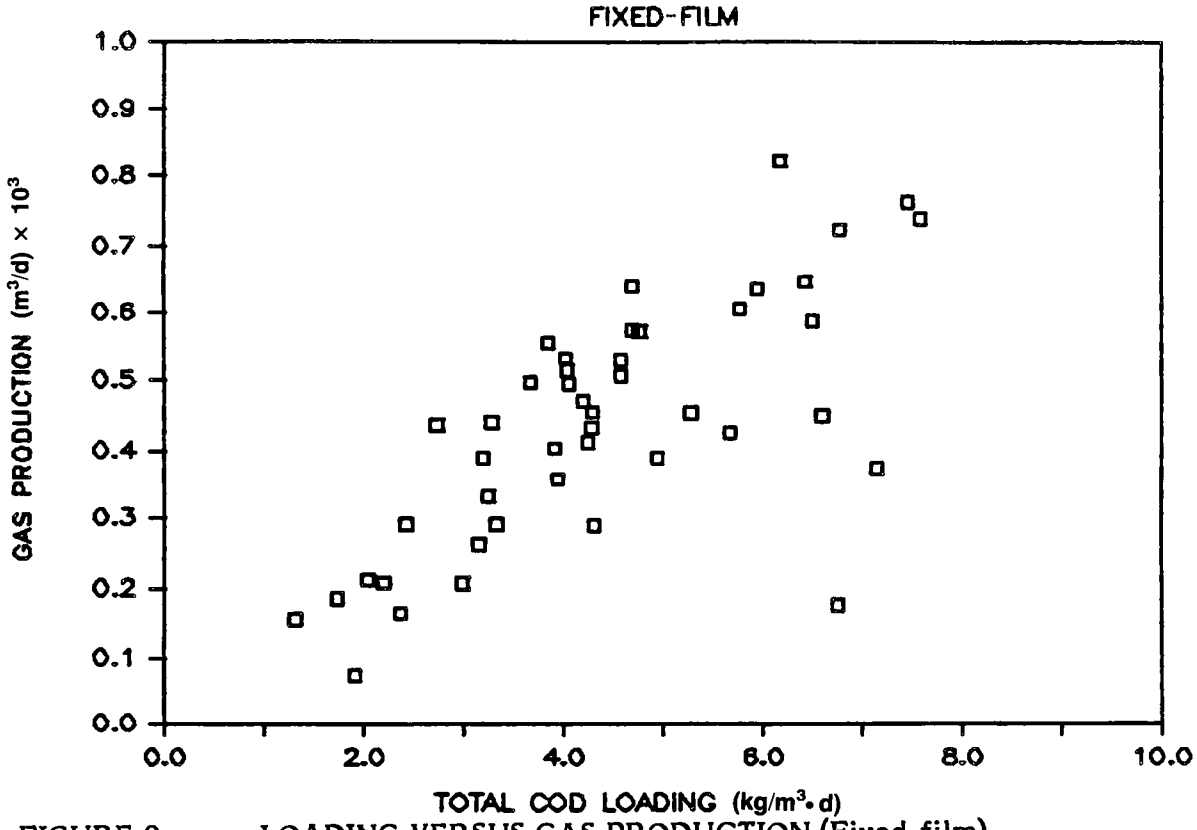


FIGURE 9 LOADING VERSUS GAS PRODUCTION (Fixed-film)

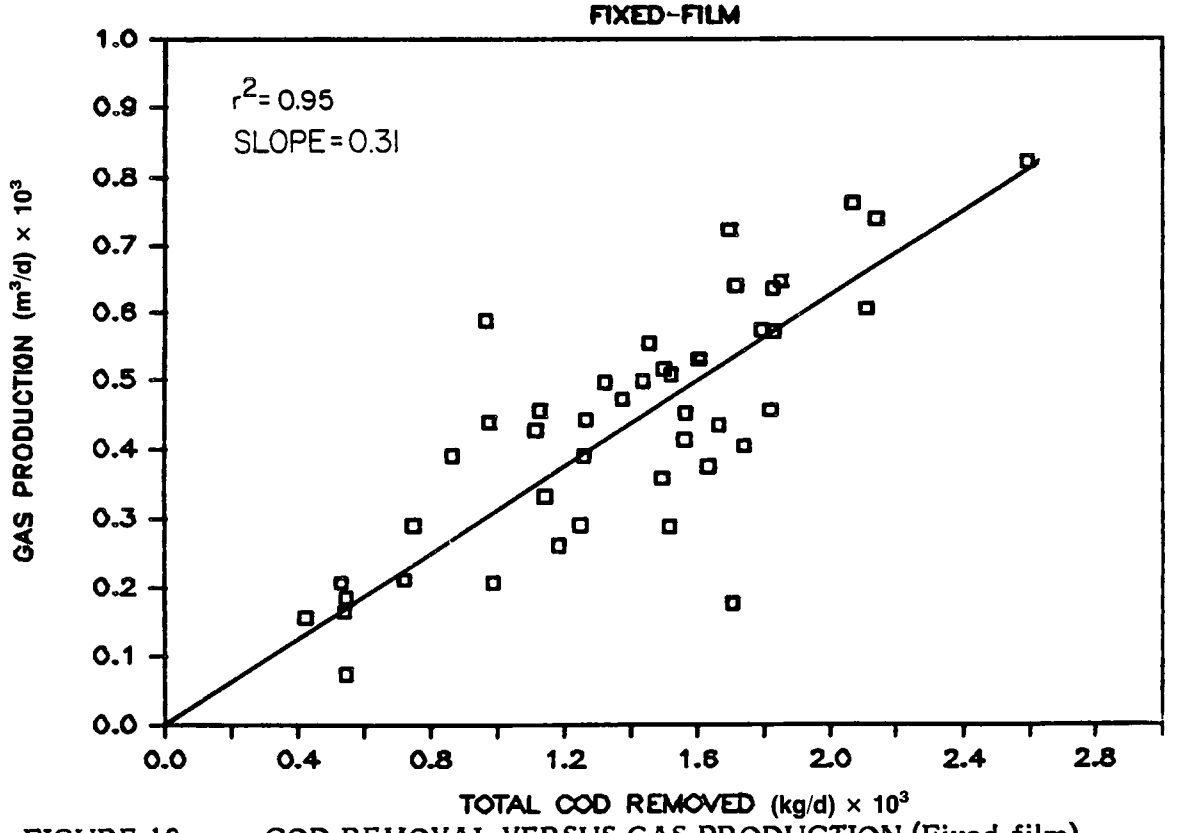


FIGURE 10 COD REMOVAL VERSUS GAS PRODUCTION (Fixed-film)

correlation was established. Gas production was also plotted against COD removed in Figure 10. As expected, a further significant correlation was established indicating a yield of 0.31 m^3/kg COD removed. This is somewhat lower than the theoretical total gas production of 0.45 to 0.50 m^3/kg that would be expected based on the measured methane content of 75 percent. The gas meters initially installed in the plant occasionally gave low, erratic readings due to plugging as they were not designed to measure wet gas flows. The meters were isolated and cleaned two or three times during the evaluation period when low gas flows were observed. The average measured weekly gas yield would probably be closer to 0.35 m^3/kg COD removed if data from the obvious erratic periods were eliminated.

4.1.2 UASB Reactor. The test period for the UASB reactor extended from March 5, 1984 until November 24, 1984. Phase 1 terminated on May 14, 1984 and Phase 2 did not commence until June 18, 1984. In the intervening period, the UASB was fed a combination of raw feed from the fixed-film reactor and recycled treated effluent. Precise flow and loading data are unavailable for this period. Loading to the UASB during Phase 1 averaged 0.3 to 0.4 kg COD/m^3·d. Even in Phase 2, the loading could be increased only to approximately 2 kg/m^3·d, well below the design value. A cumulative plot of feed and effluent total COD is given in Figure 11 and weekly averages in Figure 12. Gas production plotted in Figures 13 and 14 did not appear to match the variation in loading to the same extent as they did with the fixed-film reactor. Figure 15 presents the effects of loading on weekly average reactor effluent total COD. The low loadings on the USAB reactor allowed essentially complete removal of the applied total COD. Consequently, the total effluent COD was extremely low throughout the test period. The data show an excellent fit to a linear regression within the limited loading range tested although the correlation would be more meaningful if data at higher loadings were available.

The COD removal was generally in the 80 to 90 percent range (Figure 16). Least squares analysis indicated no dependency on loading within the range tested.

The few erratic COD data in Figure 16 are generally attributable to reactor upsets. The total COD removal for the week of August 29, 1984 decreased to 68% owing to increased loss of suspended solids after the whey spill. Removal of filterable COD remained at 90 percent plus.

Despite the apparent variation between loading and gas production observed between Figures 12 and 14, a good correlation between total COD loading and gas production (Figure 17) was obtained for weekly paired data. Figure 18 indicates the

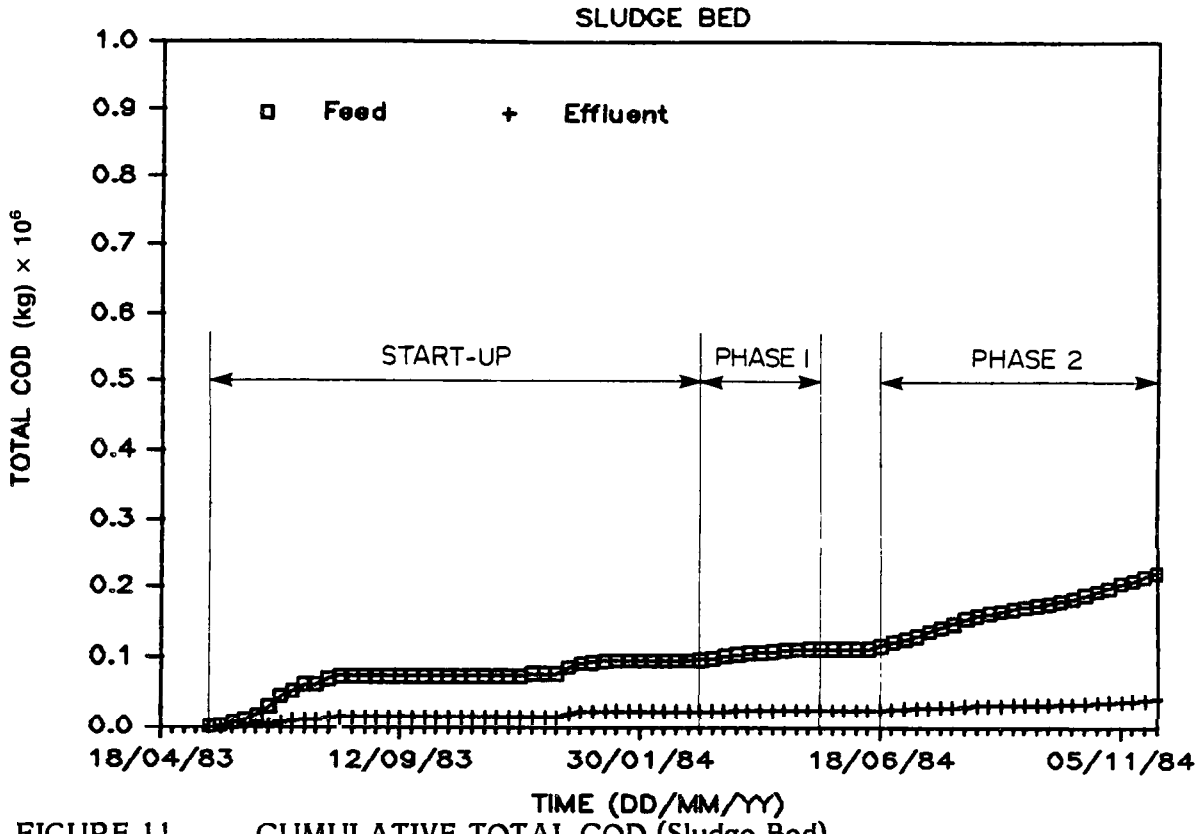


FIGURE 11 CUMULATIVE TOTAL COD (Sludge Bed)

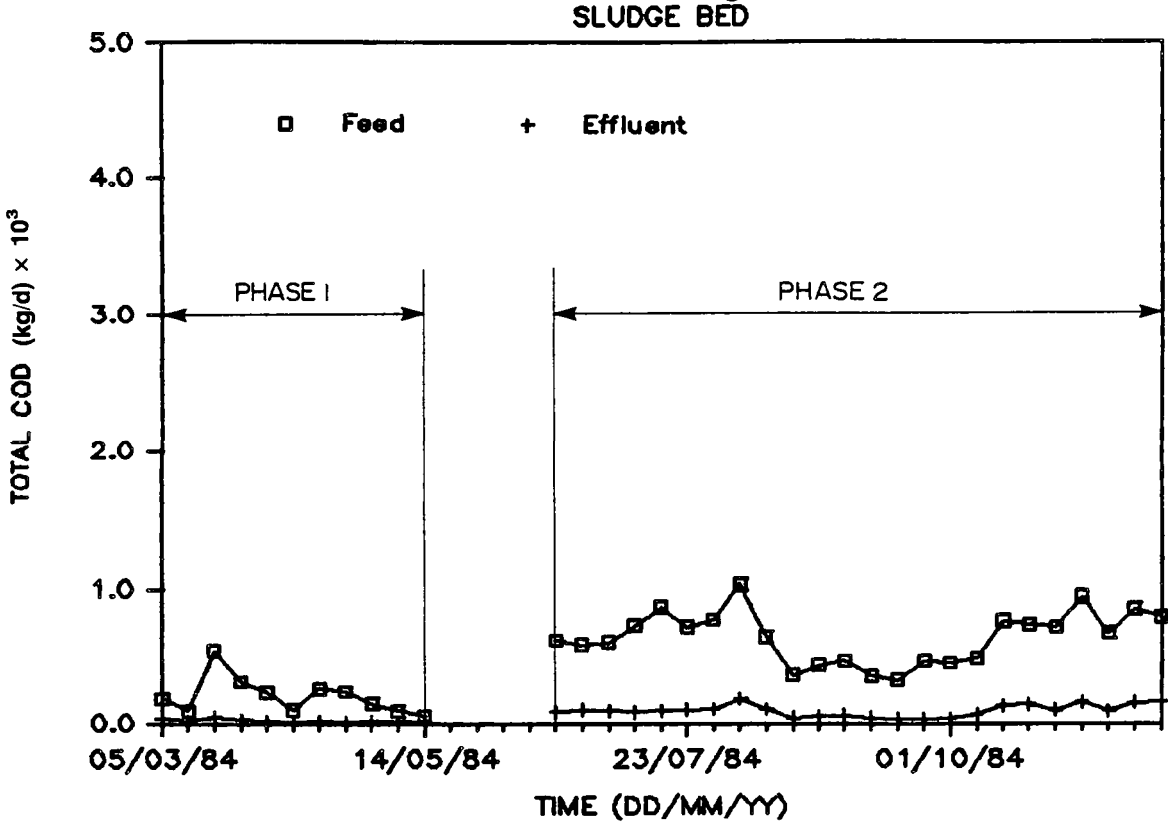


FIGURE 12 AVERAGE W KLY TOTAL COD (Sludge Bed)

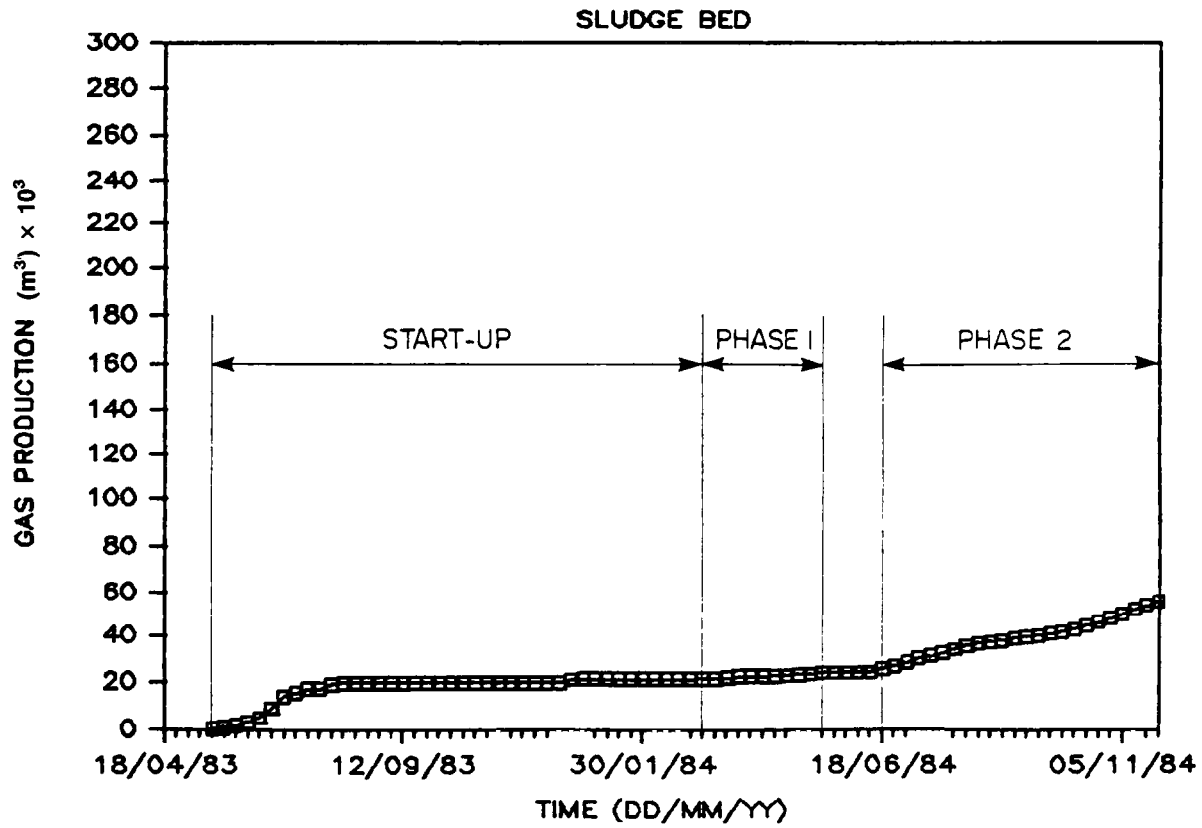


FIGURE 13 CUMULATIVE GAS PRODUCTION (Sludge Bed)

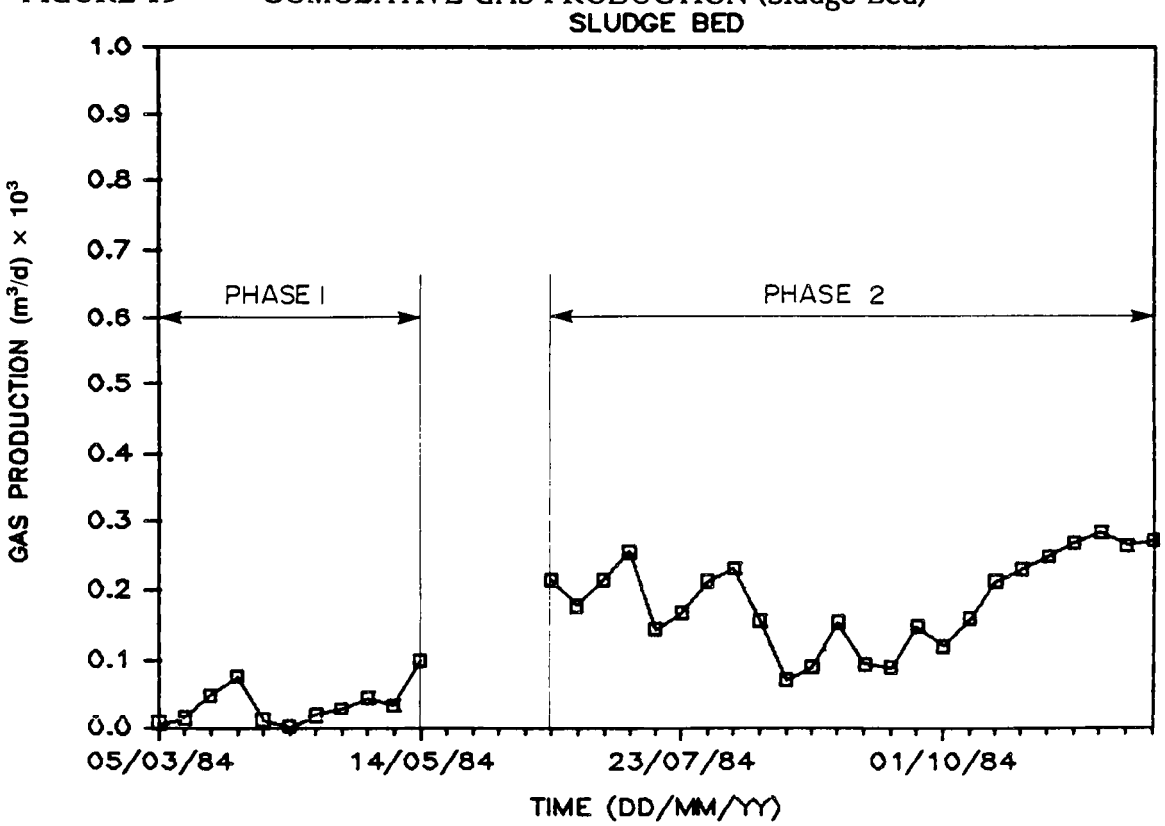


FIGURE 14 AVERAGE WEEKLY GAS PRODUCTION (Sludge Bed)

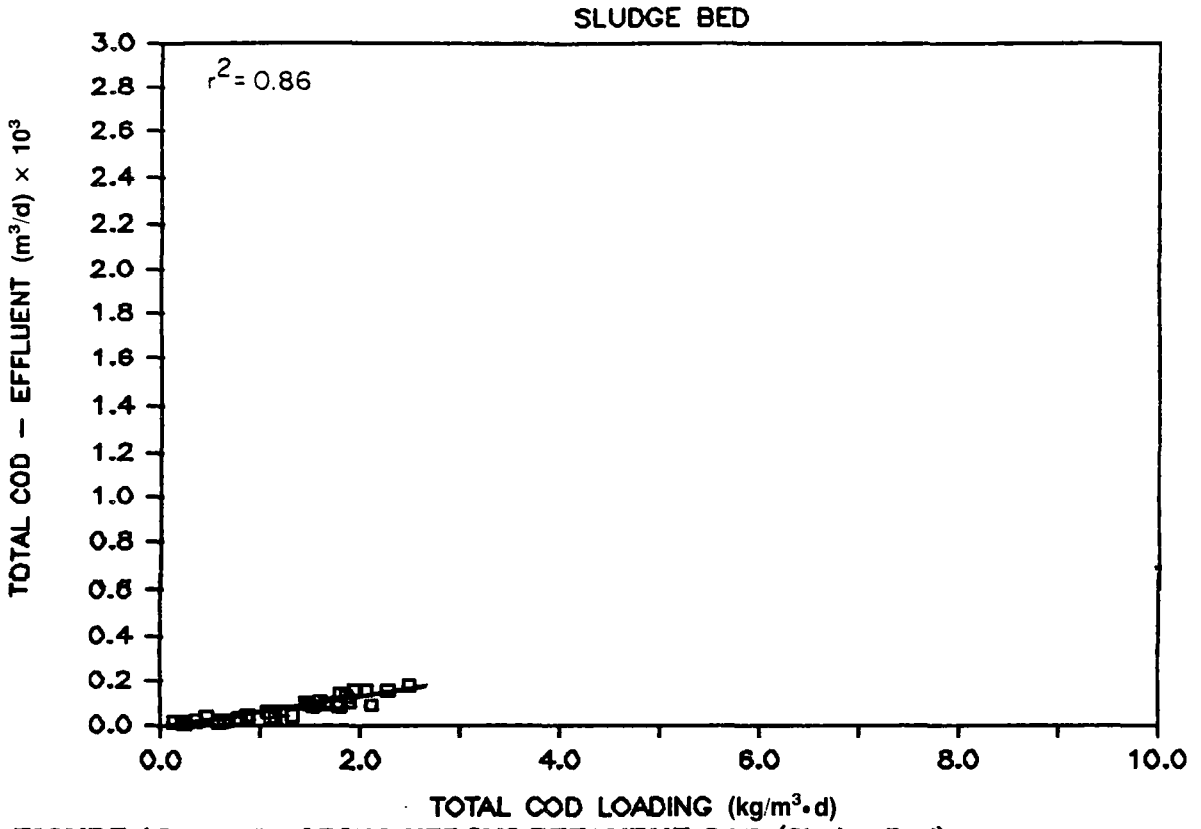


FIGURE 15 LOADING VERSUS EFFLUENT COD (Sludge Bed)

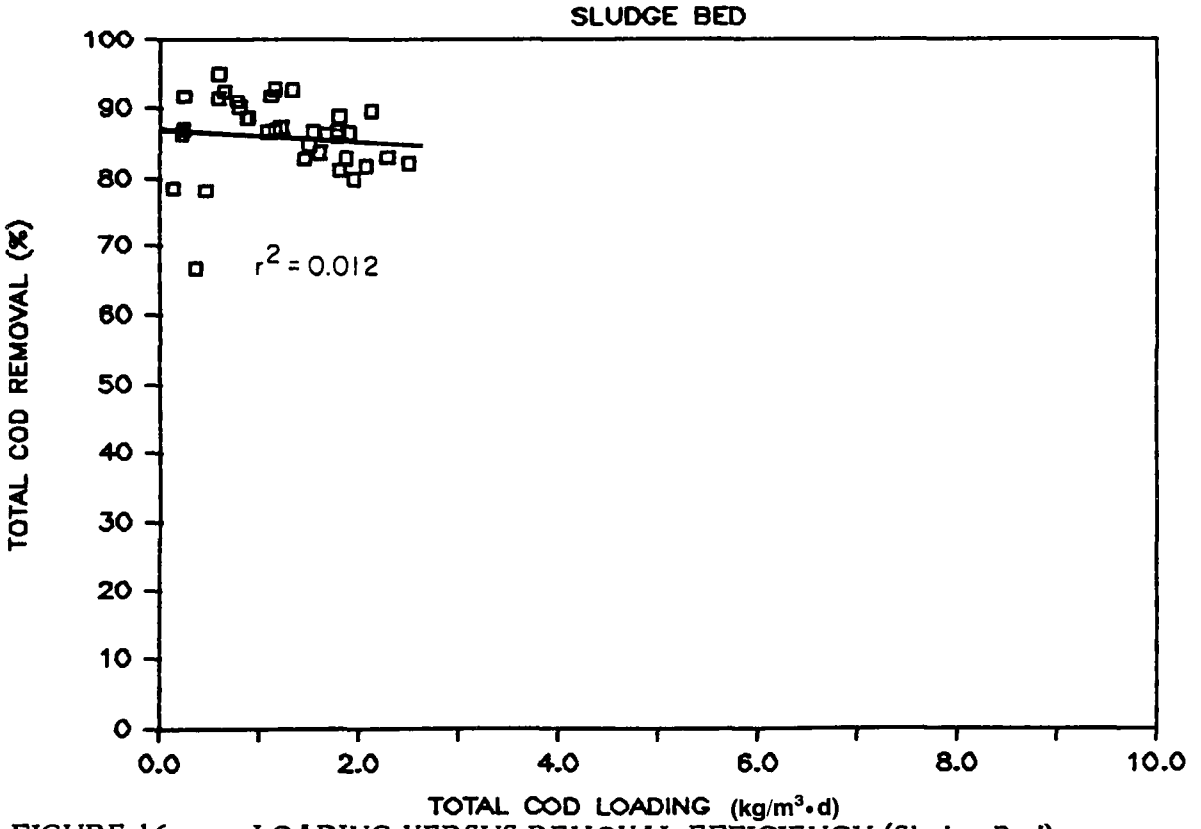


FIGURE 16 LOADING VERSUS REMOVAL EFFICIENCY (Sludge Bed)

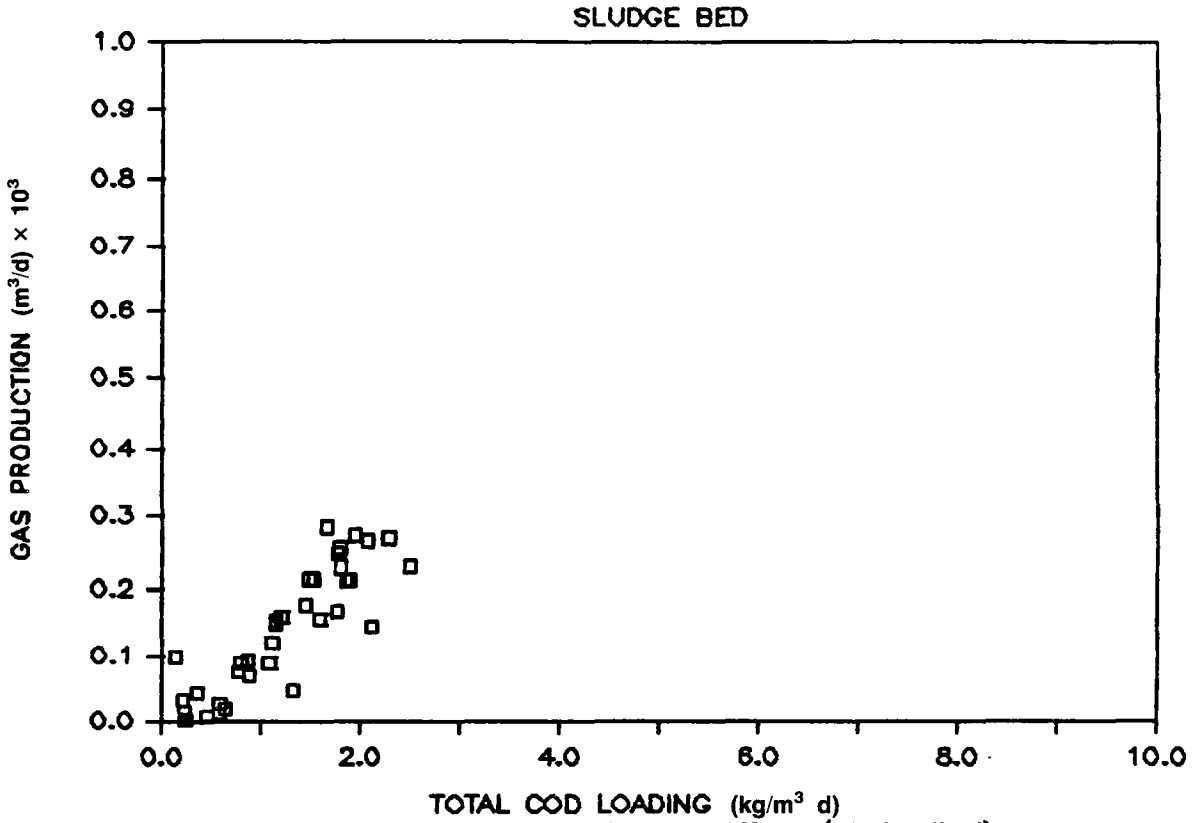


FIGURE 17 LOADING VERSUS GAS PRODUCTION (Sludge Bed)

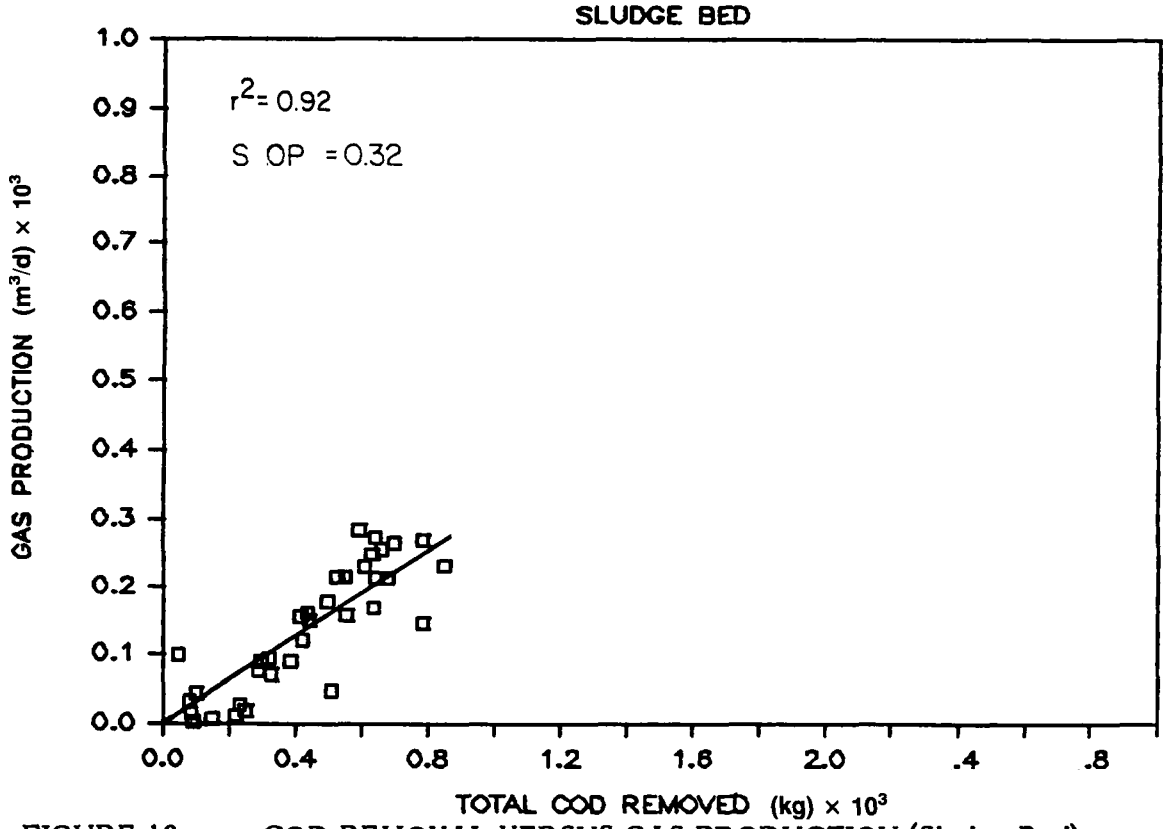


FIGURE 18 COD REMOVAL VERSUS GAS PRODUCTION (Sludge Bed)

average gas production for the UASB reactor was 0.32 m^3/kg COD. This is similar to the gas yield for the fixed-film system. As discussed previously, the real gas yield was probably closer to 0.35 m^3/kg.

4.2 Hydraulic Characterization

Reactor design in biological wastewater treatment is based upon contact of incoming wastes with acclimated microorganisms. In both packed bed and upflow sludge blanket reactors, biomass is deliberately retained or accumulated for periods in excess of the hydraulic retention period (HRT). As this is a form of segregated flow it is important to verify the active volume of the reactor and the flow characteristics within the reactor. Such information can be obtained from tracer studies employing lithium as a non-reactive tracer. A pulse of lithium is added to the influent of the reactor under a steady flow condition and samples of effluent are collected for analysis. The response measured by these samples indicates the hydraulic regime within the reactor. Plug flow conditions would be measured by an effluent response equal in magnitude to the influent pulse but lagging by a time equal to the hydraulic retention time of the reactor. Response to complete mixing would be a decay curve described by the equation:

$$C/Co = e^{-t/t'} \qquad (1)$$

where:

- C - is the measured concentration;
- Co - is the concentration which would result from the mixing of the initial tracer with the entire contents of the reactor;
- t - is the elapsed time of the effluent sample following addition of tracer; and
- t' - is the hydraulic retention time of the reactor.

Under complete mixed conditions the maximum value of C/Co would be 1.0.

Segregated flow could give rise to stagnant or dead zones. The existence of these zones would be indicated by a change in the tracer response curve. The initial C/Co ratio and the rate of decay (V/Va) would be greater than 1.0. This response is described by the modified expression:

$$\frac{C}{Co} = \frac{V}{Va} e^{-(V/Va)(t/t')} \qquad (2)$$

where:

V - is the total reactor volume; and

Va - is the active reactor volume.

4.2.1 Fixed-film Reactor. Tracer studies were conducted on the fixed-film reactor prior to process start-up on April 6, 1983, after 437 days on June 29, 1984, and following the test period on March 6, 1985 (687 days). Figure 19 compares the April 6, 1983 test tracer response to a theoretical completely mixed reactor. Both the peak value of C/Co and the rate of decay were slightly less than 1.0 indicating a response very similar to a completely mixed system. Mixing was enhanced during the test through use of gas recirculation.

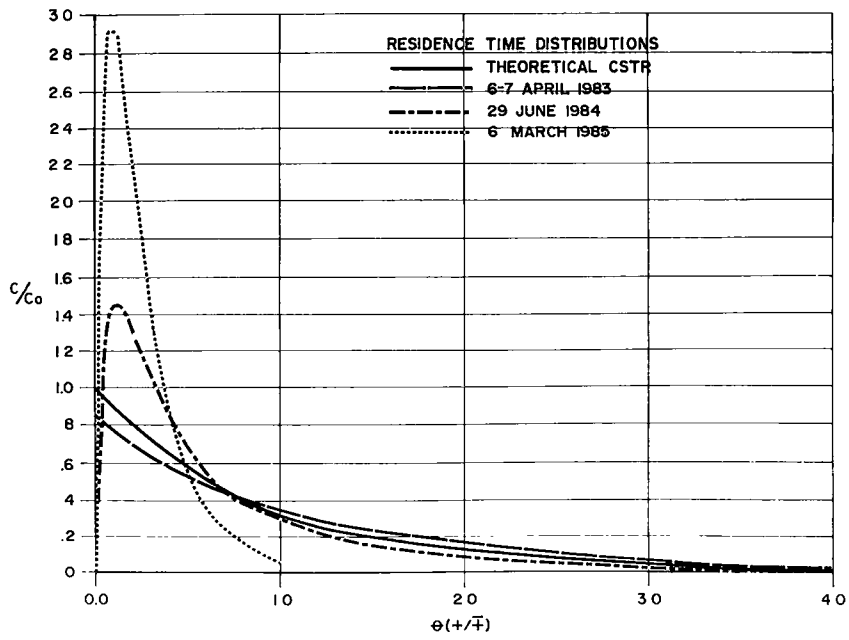


FIGURE 19 TRACER EVALUATION (Fixed-film)

After 437 days of operation, a second tracer response study was undertaken on June 29, 1984. The tracer response indicated peak values of C/Co greater than unity (C/Co = 1.56) and a decay coefficient V/Va of 1.51. This implies that biosolids accumulation had reduced the active volume by 35%.

On March 6, 1985 after 687 days operation, further tracer response testing indicated the active volume had decreased to 20% (C/Co = 5.42 and decay coefficient = 4.49). This would imply substantial blockage of passages by biomass with little or no mass flux interchange. It is acknowledged that the model utilized would not differentiate "dead volumes" from segregated volumes with limited exchange (i.e., mass transfer by diffusion as opposed to mass flux). It should be noted that the final tracer study was completed after gas scouring of the media using the recirculation blower.

4.2.2 Sludge Blanket. No segregated flow should occur in sludge blanket reactors, as no interior packing is employed. This was verified by the tracer response study illustrated in Figure 20. As with the initial tracer response obtained with the fixed-film reactor C/Co and decay coefficients were less than 1.0 (C/Co 0.88 and the decay coefficient -0.78) indicating a completely mixed reactor without dead spaces. As no interior packing was present additional tracer response testing was not carried out.

4.2.3 Implications on Reactor Performance. Figure 7 indicates that the effluent total COD is a direct function of loading expressed as mass of COD per unit of reactor volume and unit time. A reduction in the active volume increases the actual loading per unit volume and decreases the residence time. This in turn affects the effluent COD.

The loading in Figure 7 was based on the total reactor volume of 550 m^3. The available volume at start-up would have been the void volume (e.g., subtract displacement volume of the clay media) which was 410 m^3. Figure 21 presents observed effluent total COD data and the estimated values from a least squares fit as a function of loading per unit initial void volume. The differences between the observed effluent values (Y) and those predicted by the least squares line of best fit ($\hat{Y}$) are the residuals ($Y-\hat{Y}$). These should be distributed randomly. Figure 22 indicates that the residuals show a marked trend to increase from negative to positive values over the duration of the test period. This would imply that the regression equation for fixed-film reactor initially overestimates the actual effluent values but underestimates effluent values in the latter stages of the test period. This would be consistent with the finding that the available void volume was reduced by plugging.

Plots similar to those in Figures 21 and 22 were made for the UASB reactor. The plots of residuals are presented in Figures 23 and 24 and show no recognizable trend.

The results of the tracer studies were used to develop an estimate of the change in inactive reactor volume with time for the fixed-film system (Figure 25).

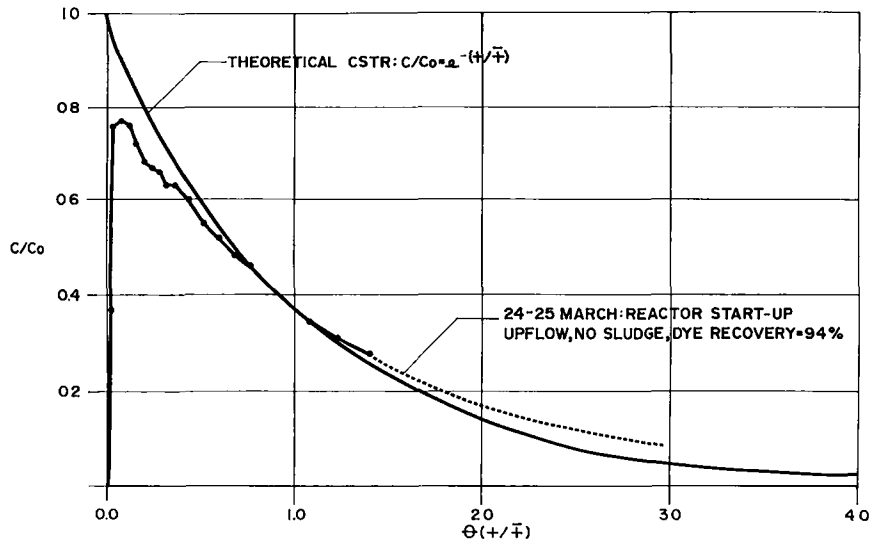


FIGURE 20 TRACER EVALUATION (Sludge Bed)

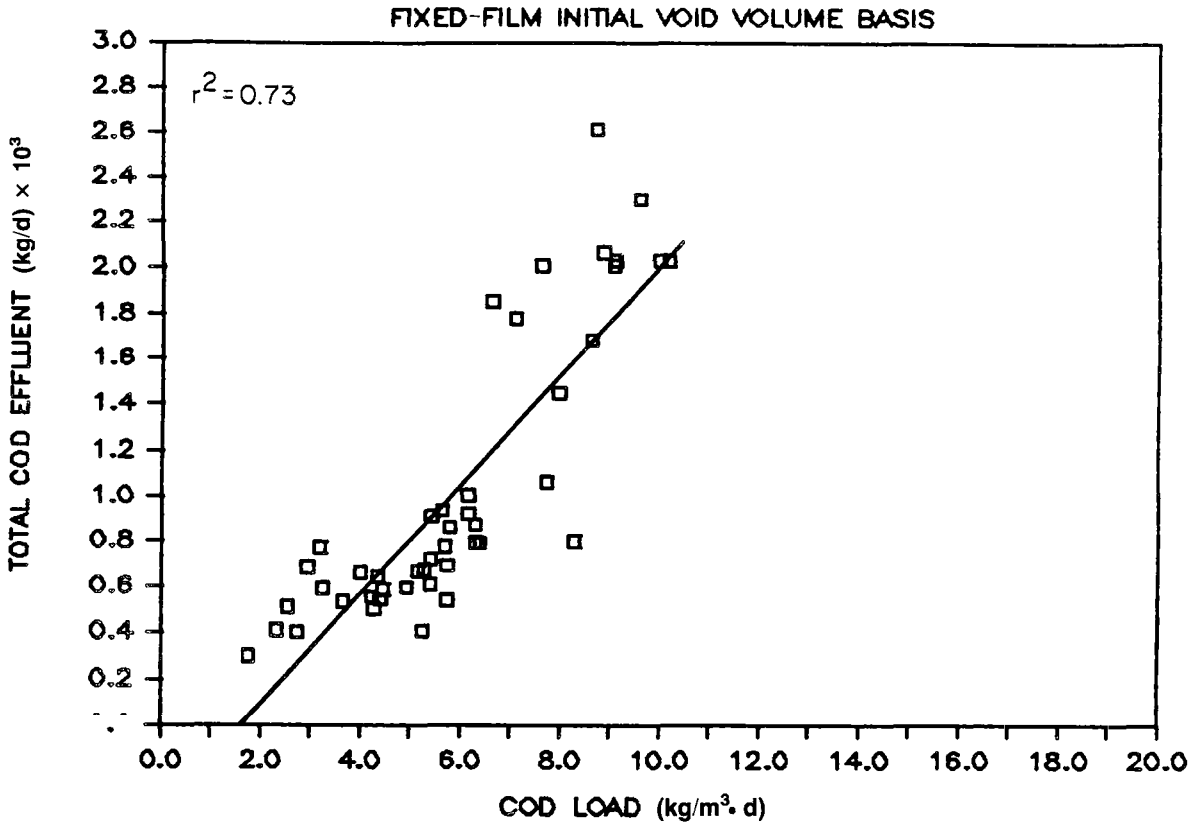


FIGURE 21 LOADING VERSUS EFFLUENT COD (Fixed-film initial void volume basis)

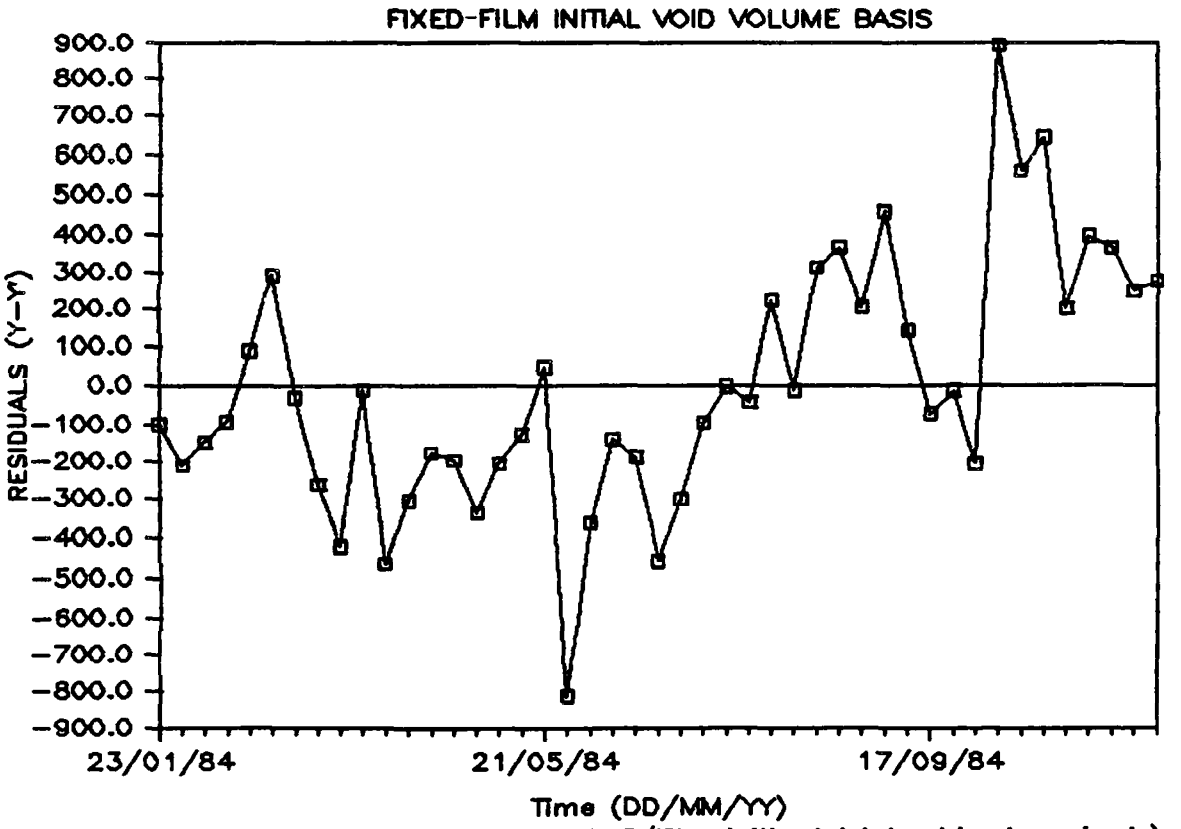


FIGURE 22 ANALYSIS OF RESIDUALS (Fixed-film initial void volume basis)

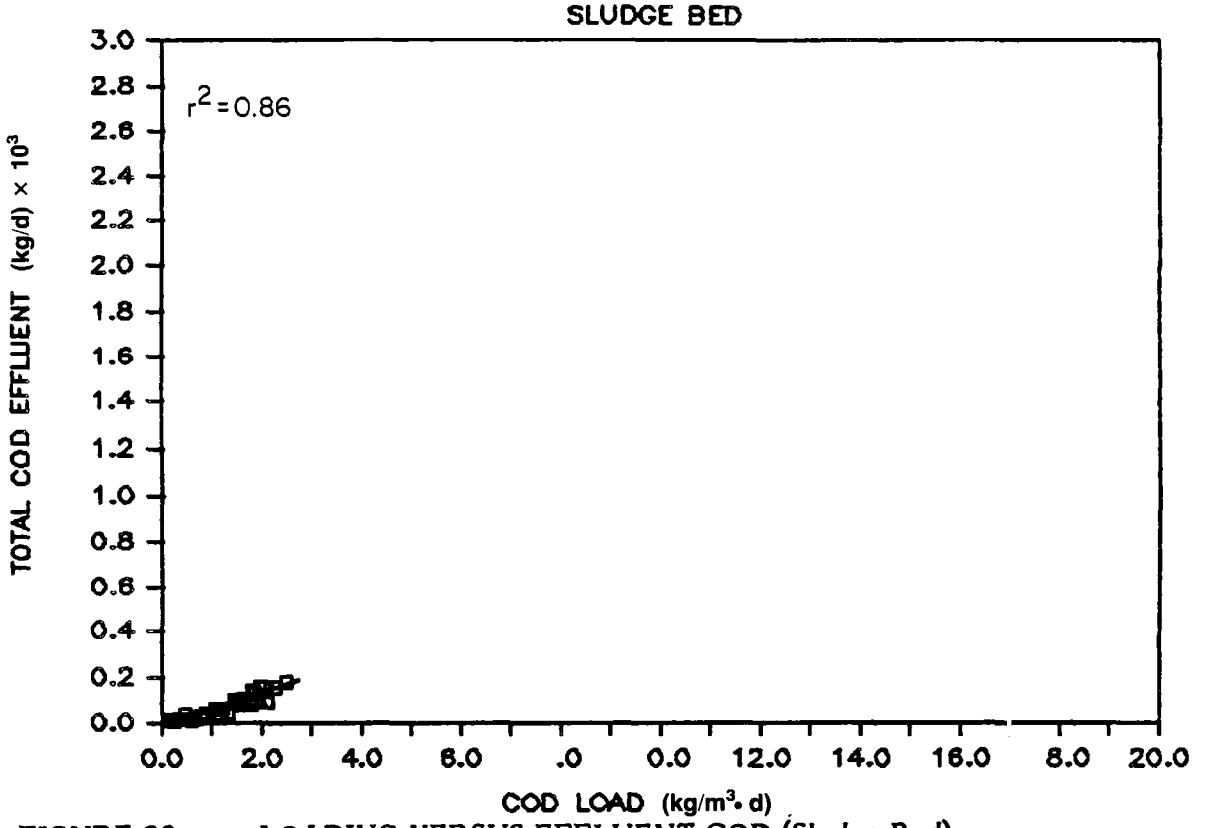


FIGURE 23 LOADING VERSUS EFFLUENT COD (Sludge Bed)

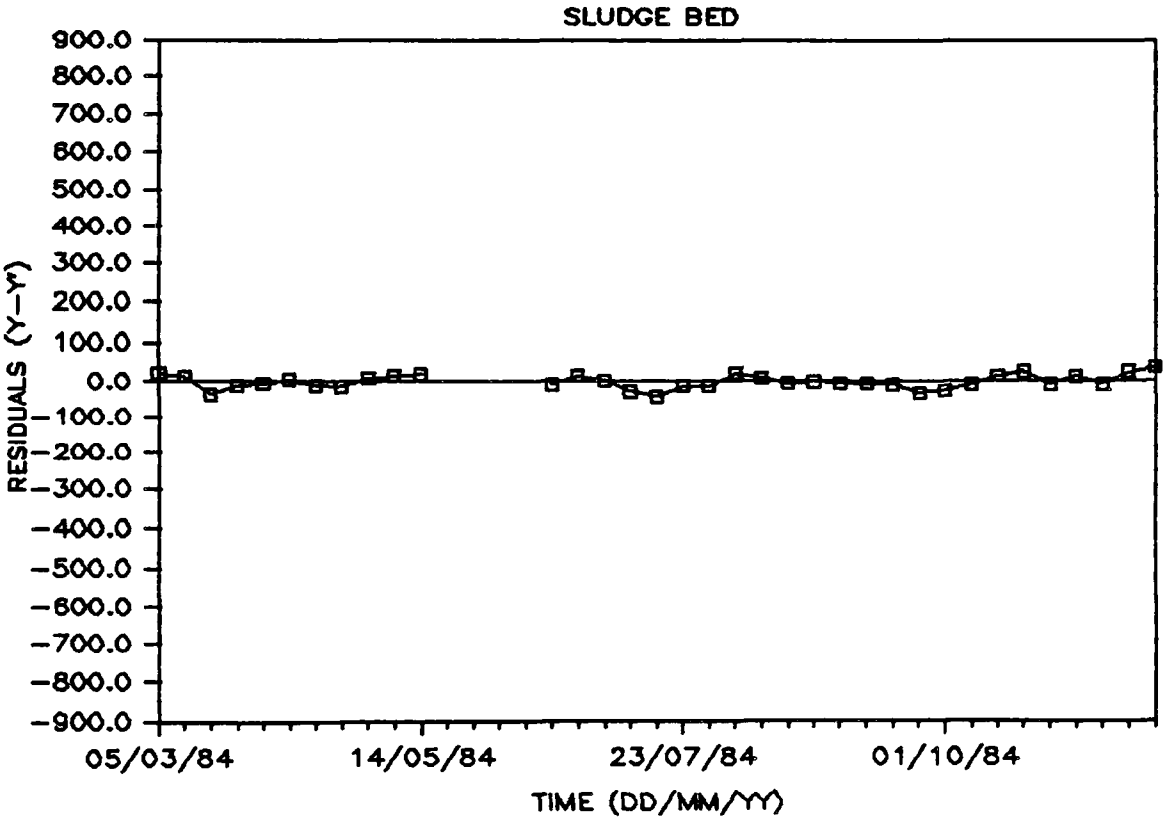


FIGURE 24 ANALYSIS OF RESIDUALS (Sludge Bed)

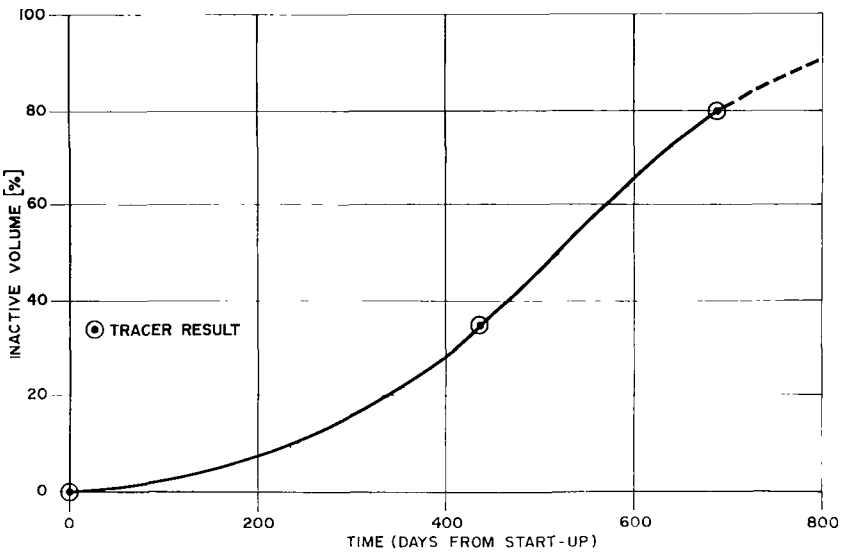


FIGURE 25 INCREASE IN INACTIVE REACTOR VOLUME (Fixed-film)

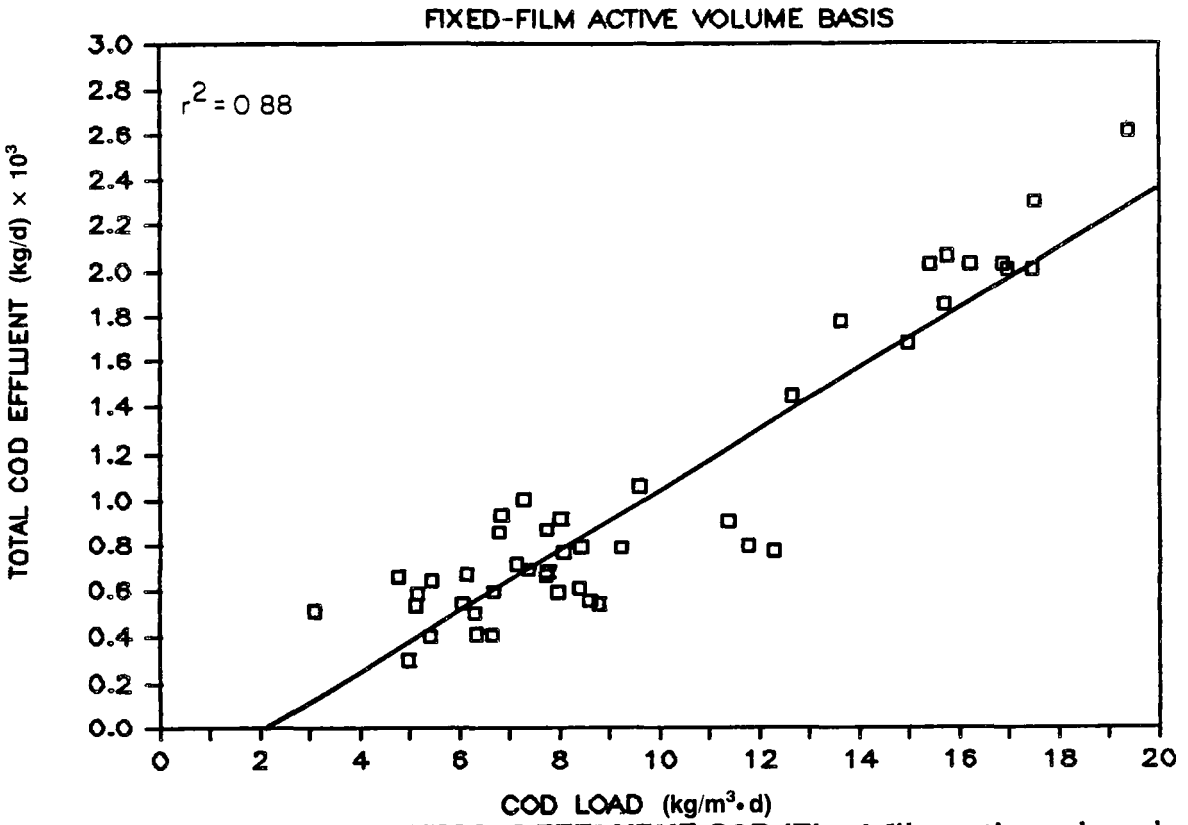


FIGURE 26 LOADING VERSUS EFFLUENT COD (Fixed-film active volume basis)

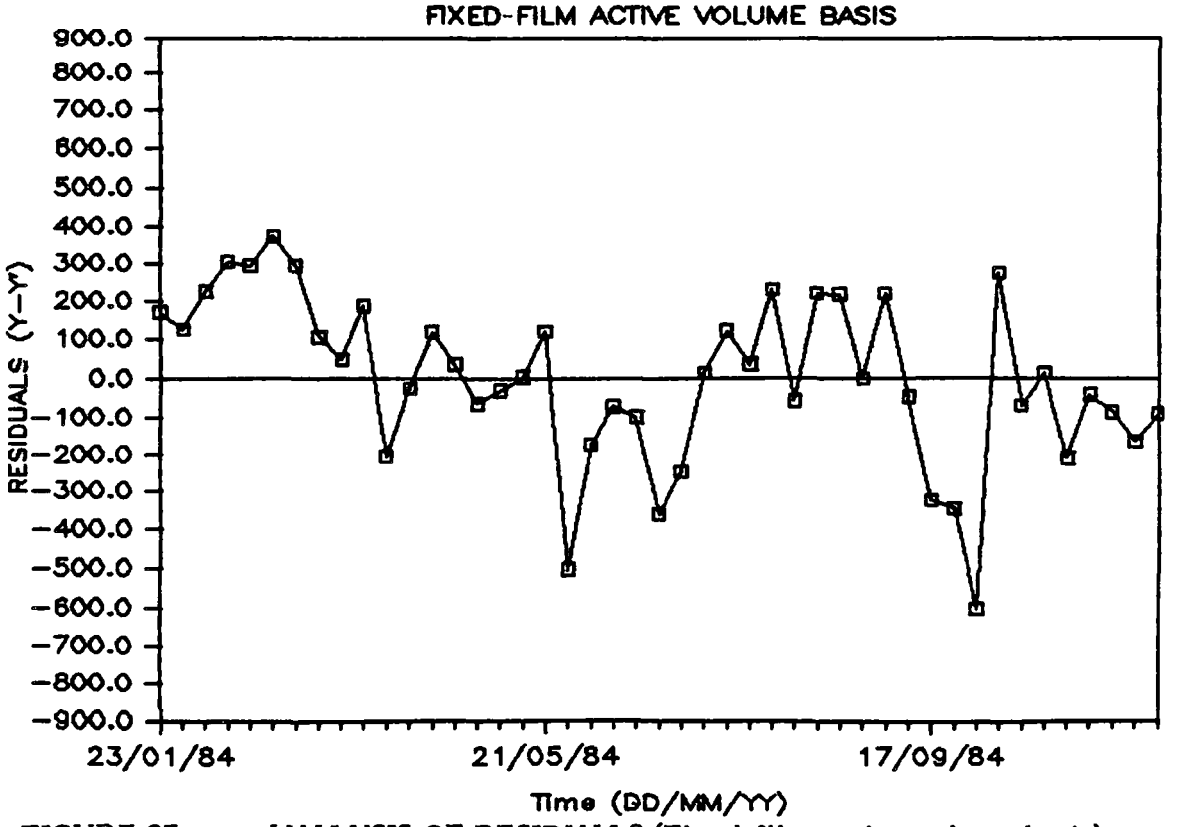


FIGURE 27 ANALYSIS OF RESIDUALS (Fixed-film active volume basis)

Figure 21 was then replotted as Figure 26 with COD loads calculated using kilograms of COD per cubic metre of active bed volume per day. The residuals (observed minus predicted values) were plotted in Figure 27. The trend from negative to positive residuals initially present in Figure 22 is no longer present. The correlation coefficient of 0.94 (r^2 = 0.88) for the regression line using estimated active bed volume also would indicate a better fit than the original regression using initial void volume (r^2 = 0.73). The calculation of residuals for Figures 22, 24 and 27 is presented in Appendix 4.

One additional method was used to examine the rate of reactor plugging. The fixed-film reactor was shut down and inspected on February 10th, 1984. One clay block was removed from the top of the reactor and a portion of the biomass film was scraped from a carefully measured area to estimate biomass accumulation in the reactor. The film was measured at 2 to 3 mm thickness. The total volume of biomass in the reactor would have been 50 to 70 m^3 at an effective consistency of 16 to 24 percent TSS assuming uniform biomass growth throughout the entire 24 000 m^2 of surface in the reactor. The inactive volume in the reactor at that time predicted by Figure 24 is 16 percent. This is equivalent to 66 m^3 of biomass accumulation which is within the 50 to 70 m^3 range previously estimated.

4.3 Suspended Solids and Sludge Characteristics

4.3.1 Effluent Solids and Sludge Production. Sludge samples from both reactors were thick and gritty in texture similar in many ways to "granular" sludges often reported as essential to effective operation of UASB systems. Analyses indicated that both sludges consisted of approximately 60 percent volatile and 40 percent non-volatile material and the UASB sludge settled to 9 to 10 percent total solids. A sample of sludge from the UASB was analyzed for calcium since calcium carbonate was suspected to be a major component of the inorganic fraction of the sludge. Calcium represented 38 percent of the sludge ash, which would account for 95 percent of the non-volatile component of the sludge if all of the calcium were present as carbonate. The volatile solids testing procedure raises the sample to 550°C. At this temperature any calcium initially present as bicarbonate would be changed to carbonate. Carbon dioxide is not driven from carbonate until temperatures in excess of 850°C are reached.

Figures 28 and 29 show the concentration of suspended solids entering and leaving the anaerobic reactors during the last 30 to 40 weeks of the performance evaluation along with the weekly pattern of COD loading. Effluent suspended solids concentrations were consistently lower than influent concentrations in both cases. This

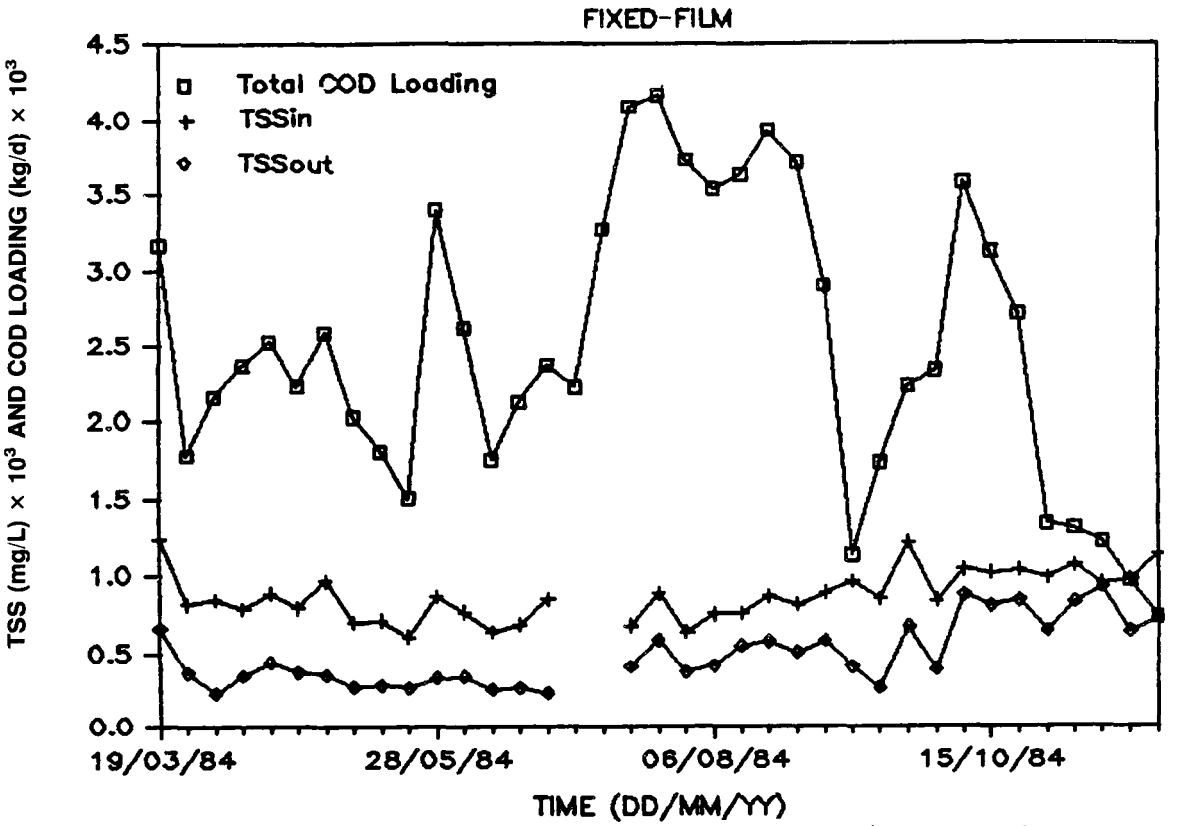


FIGURE 28 COD LOADING AND SUSPENDED SOLIDS (Fixed-film)

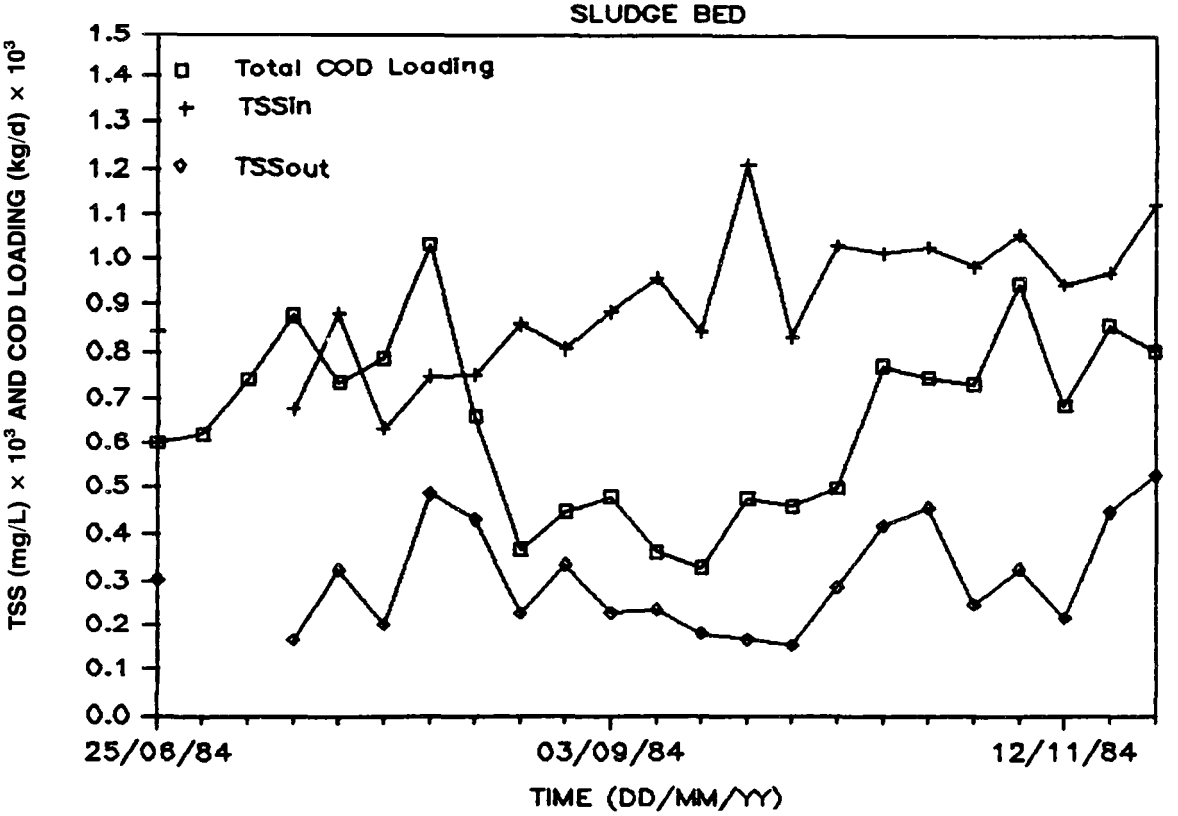


FIGURE 29 COD LOADING AND SUSPENDED SOLIDS (Sludge Bed)

was expected as the solids in the equalization basin were approximately 90 percent volatile as seen previously in Table 1. This suggests that they were generally biodegradable.

Effluent TSS from the fixed-film reactor averaged 200 to 300 mg/L less than influent values. The highest effluent concentrations appear to be associated with periods of high loading and the last two months of operation. Actual HRT's in the reactor under these conditions would have been relatively short (6 hours and less) providing less time for hydrolysis and biodegradation of the feed solids. The operating records show that there was no significant difference in the volatile fraction between the influent and effluent solids, which supports the hypothesis that the majority of the TSS in the feed was passing directly through the reactor.

The relationship between influent and effluent suspended solids in the UASB reactor differed from the behaviour in the fixed-film reactor. An analysis of weekly average data between March and November, 1984 showed that the non-volatile fraction of the effluent TSS was 14 percentage points lower than in the feed. This relationship was consistent and suggests that a significant portion of the effluent suspended solids were acclimatized anaerobic organisms being lost from the system. Close to 50 percent of the TSS loss in the final effluent could have been sludge bed solids if the simplifying assumption is made that the sludge bed contained 60 percent volatiles and influent solids contained 89 percent volatiles. This was symptomatic of the difficulties encountered in accumulating a substantial bed volume of anaerobic sludge in the UASB. Total anaerobic sludge formation during treatment would barely match the above rate of loss.

In general, the total effluent suspended solids concentration was lower in the UASB system. It must be kept in mind, however, that the COD loading was much lower and the actual hydraulic residence time was as much as 10 times greater (e.g., as much as 48 hours) in the UASB reactor if inactive bed volume in the fixed-film system is considered.

Figures 30 and 31 are cumulative plots of total COD removed and total effluent suspended solids in kilograms for the two treatment processes. The average solids discharge for the fixed-film system was 0.24 kg TSS per kg of total COD removed which was two and a half times the value for the UASB reactor. The data for the fixed-film reactor ignore the effect of solids accumulated in the reactor during the test period which could have accounted for an additional 30 000 kg based on estimates made from the data presented previously. This would increase the total value of gross yield to 0.33 kg TSS/kg COD removed. It should not be interpreted that this is the yield of anaerobic

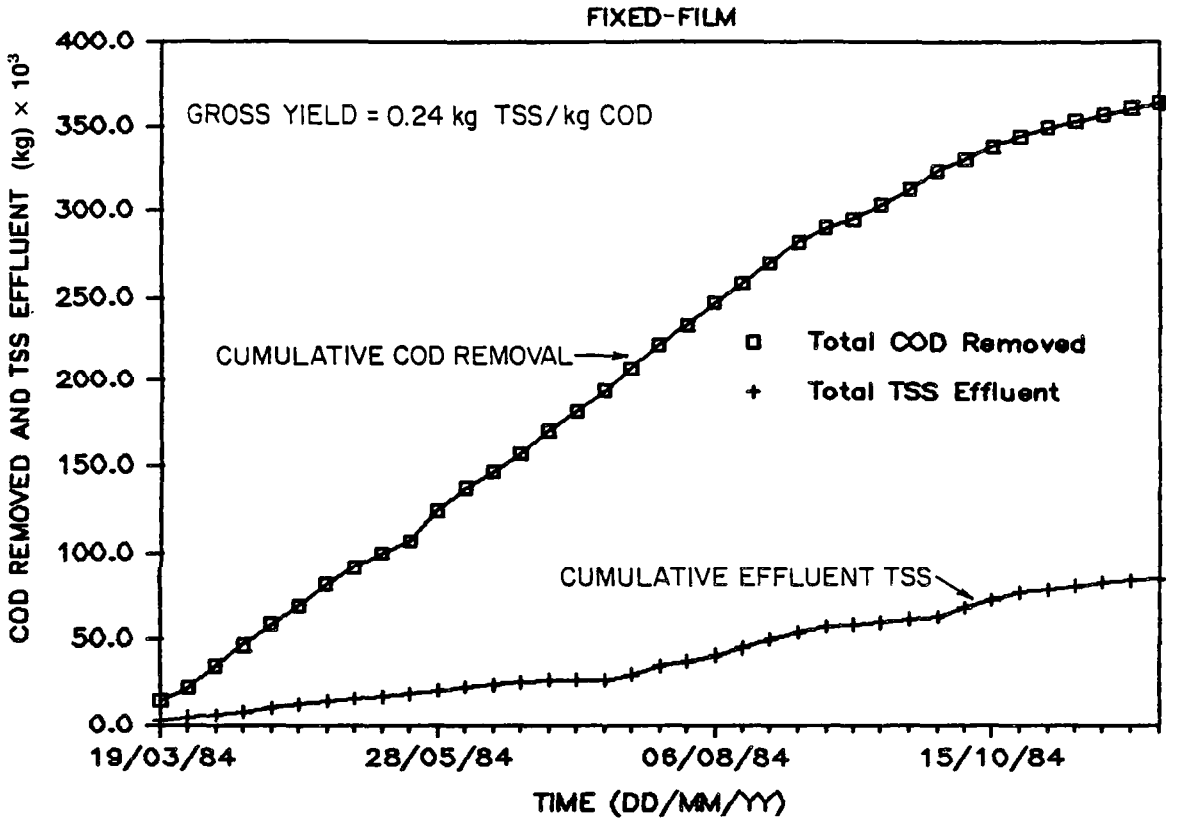


FIGURE 30 GROSS SOLIDS YIELD (Fixed-film)

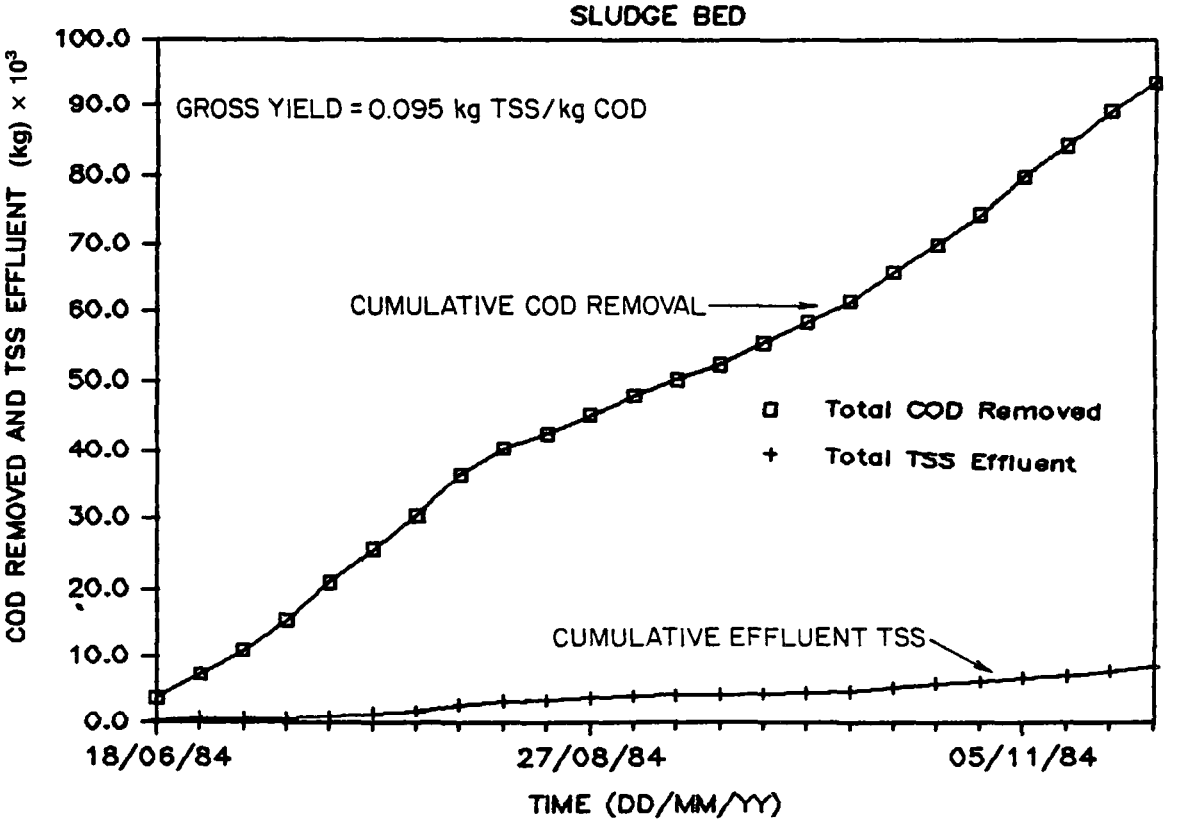


FIGURE 31 GROSS SOLIDS YIELD (Sludge Bed)

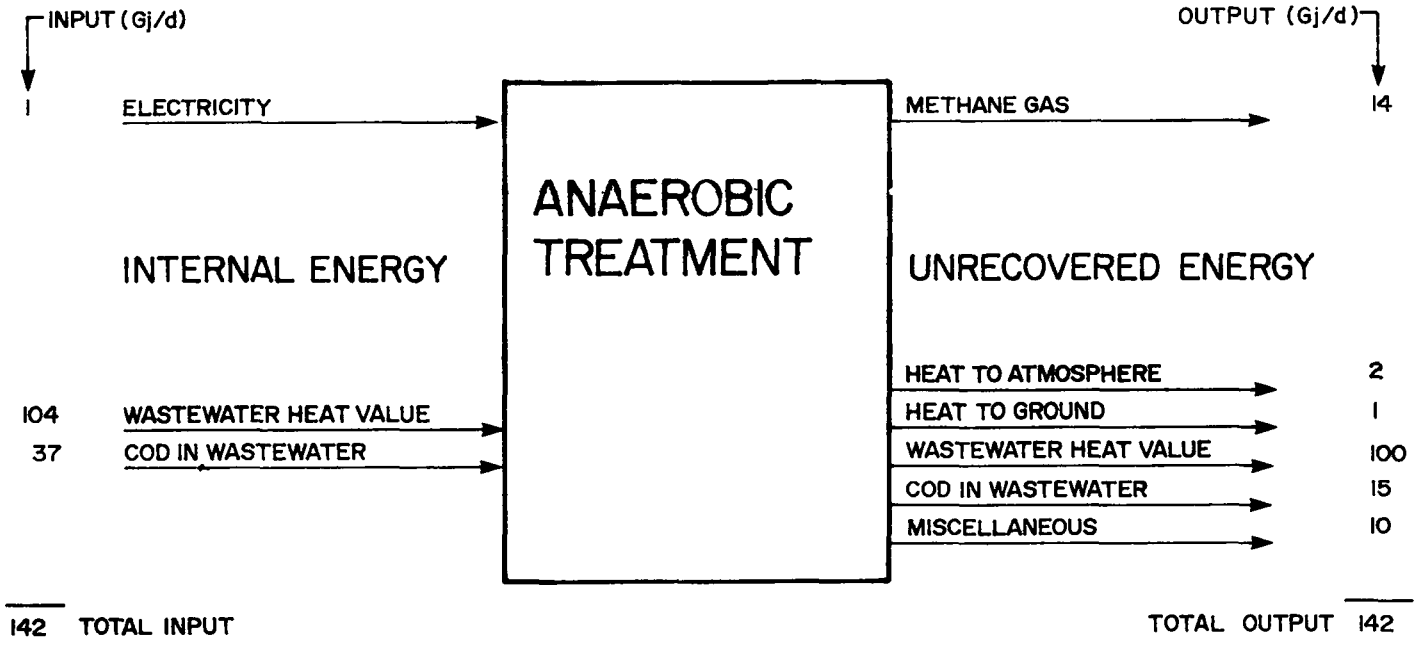
organisms as the above value includes the effect of influent suspended solids not degraded during treatment.

There was little or no net increase in the sludge bed volume in the UASB reactor during the period plotted in Figure 31. The TSS in the final effluent, therefore, represented the combination of anaerobic sludge produced and primary TSS not treated in the reactor. The true anaerobic sludge yield would have been approximately 0.05 kg TSS/kg COD removed it if is assumed that 50 percent of the effluent solids originated from the anaerobic sludge bed as estimated earlier in this section. This value would be consistent with yield data for anaerobic processes.

5 ENERGY BALANCE AND PROCESS ECONOMICS

5.1 System Energy Balance

A detailed energy balance was calculated for the anaerobic treatment process starting at the pump station and terminating with the anaerobic treated effluent leaving the treatment building. The balance is presented diagramatically in Figure 32 with energy input on the left and outputs on the right. The fixed-film reactor operating at its design flow and COD loading was the basis for the balance. Approximately 60 percent COD removal was achieved during the period of performance evaluation at this loading (see Figure 8). The significant parameters used in determining the individual energy inputs and outputs are listed in Table 3. A standard thermodynamic approach using heats of combustion was applied in calculating the potential energy associated with the various organic constituents of the wastewater.



* Includes energy accumlated in solids inside reactor plus net error in individual calculations of energy values

FIGURE 32 ENERGY BALANCE (Fixed-film process)

TABLE 3 BASIS FOR ENERGY BALANCE (Fixed-film Reactor)

Reactor		Fixed-film System	
Wastewater Characteristics			
Flow		800	m^3/d
COD		3390	mg/L
COD Components -	Carbohydrate	15	%
-	Fats	24	%
-	Protein	33	%
-	Volatile Acids	28	%
COD Removed		60	%
Gas Production			
Specific Rate		0.31	m^3 gas/kg COD
Methane Content		75	%
Heat Value		0.0357	Gj/m^3 methane
Temperatures			
Wastewater Influent		30	°C
Wastewater Effluent		30	°C
Ground		10	°C
Ambient		-10	°C

It was recognized that the hydrochloric acid and lime used for pH control in the buffer tank consume energy in their production and transportation to site. In a strict thermodynamic sense, however, these chemicals add little real energy to the process and they were therefore omitted from the balance. The significance of the lime and acid to process economics is discussed in the next section.

The first observation that can be made from the energy inputs shown in Figure 32 is that the external energy added to the process through power consumption is trivial compared to the sensible heat contained by the untreated wastewater. This demonstrates the importance of a sufficiently warm wastewater to an energy effluent anaerobic process. For example, the heat content of the wastewater would be reduced from 104 to 67 Gj/d if the initial temperature were 20°C instead of 31°C, the design

temperature for this system. The difference is 37 Gj/d which is more than two and half times the energy available from methane production.

The total theoretical heat value of the methane recovered and used in the boiler averaged 14 Gj/d which was significantly higher than the external energy input required for operating the process. This offers a far better gross energy balance than does conventional aerated basin treatment. Table 4 shows that the difference in net external energy requirements between the anaerobic fixed-film system and an equivalent aerated basin system would be 21 Gj/d. The difference would increase substantially if the energy costs associated with dewatering and disposing of waste biological sludge from an activated sludge process were considered.

TABLE 4 ENERGY CONSUMPTION (Anaerobic vs. Aerobic Treatment)

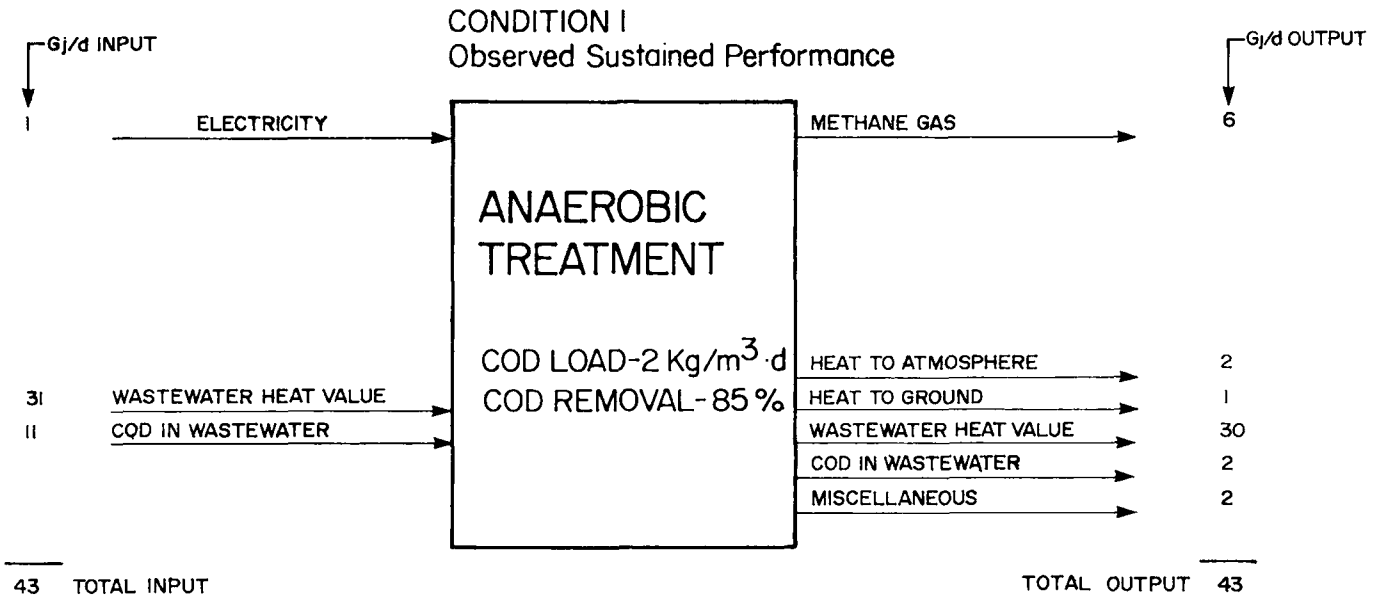
	Anaerobic Fixed-film Reactor (Gj/d)	Aerated Basin for Equivalent COD Removal (Gj/d)
External Energy Required		
Power	1	8
Recovered Energy		
Methane	(14)	0
Net External Energy	(13)	8

The organic compounds in the wastewater account for 37 Gj/d in the system energy inputs or about 25 percent of the total. Close to 65 percent of the energy value of the COD removed during treatment was recovered as methane gas. In general a recovery of 80 to 90 percent would be expected for anaerobic treatment. Recall, however, that the measured gas flows were probably underestimating real gas production because of periodic problems with the flow meters.

Figure 33 shows energy balances for the sludge blanket system for the observed and the original design condition as follows:

Observed: COD Load of 2.0 kg/m^3-d and 85 percent removal

Design: COD Load of 6.7 kg/m^3-d and 70 percent removal



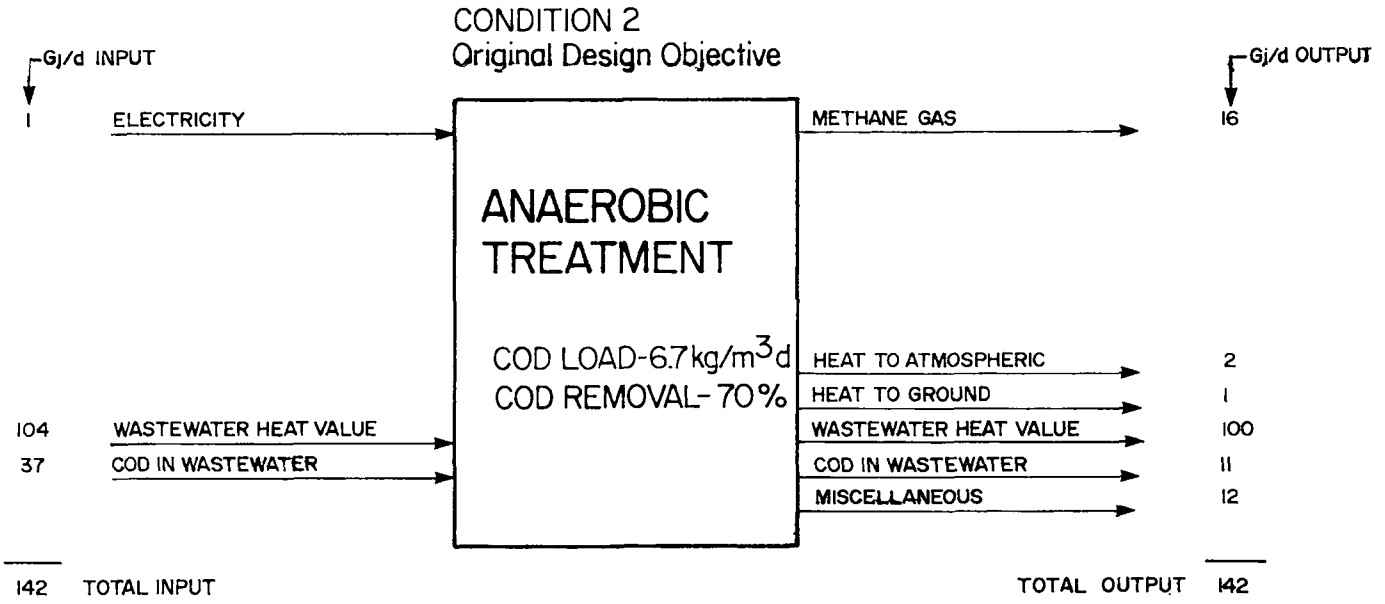


FIGURE 33 ENERGY BALANCE (UASB Process)

The net energy of the methane gas produced by the UASB was lower than the design value as the actual COD loading was only 2 $kg/m^3 \cdot d$.

5.2 Analysis of Capital and Operating Costs

The total capital cost for the entire treatment system was $1.7 million. This included the effluent delivery system, the gas handling facilities and the aerated polishing basins as well as the building and anaerobic reactors.

The aerated basin process or a low rate activated sludge type process would have been the conventional treatment method applicable at Notre-Dame-du-Bon Conseil had the anaerobic/aerobic system not been built. A rough estimate was made of the cost for aerated basin treatment alone. The capital estimate was approximately the same as the total cost of the present facility assuming that a primary clarifier would have been included in such a system. The additional cost of the clarifier and sludge handling equipment and the cost of extra aeration equipment would have been approximately the same as costs for the anaerobic reactors and related facilities. It is doubtful, however, that an aerated basin system routinely would achieve the 50 mg/L limit set for total suspended solids in the final effluent. Furthermore, declining operating temperatures during the winter would reduce removal efficiencies for BOD_5 for several months each year.

The estimated cost of a low rate activated sludge system was $2.6 million or about 50 percent more than for the anaerobic/aerobic treatment system. The need for equipment to thicken and dewater the waste biological sludge is the main contributor to the higher cost. Without dewatering there could be an average of 30 m^3/d or more of sludge requiring hauling based on 1200 kg/d of waste solids at 2 percent total solids by weight. It would probably be more economical to dewater the sludge before hauling to disposal because of the large volumes involved.

Table 5 presents a summary of annual costs for operating and maintenance. The total cost for the treatment system, including secondary aerobic treatment, is close to $100 000 per year of which the cost for neutralizing chemicals was the largest single contributor. Several assumptions were made in developing this summary because of the unsteady operation/performance of the anaerobic reactors. Recovered value for gas production was based on replacement of an equivalent heating value of No. 6 Fuel Oil which was the fuel used in the plant boiler until recently. The average cost of fuel oil was $0.22/L which is equivalent to $0.19/$m^3$ of methane. No allowance was made for small changes in boiler efficiencies from dual fuel burning and the data represent the

TABLE 5 OPERATING AND MAINTENANCE COSTS (Anaerobic and Aerobic Treatment)

	Fixed-film ($/y)	UASB ($/y)	Combined ($/y)
Operator Salaries	15 000	15 000	30 000
Maintenance - Equipment	2 500	2 500	5 000
- Building	1 250	1 250	2 500
Laboratory Supplies/Equipment	9 000	9 000	18 000
Power - Aeration Compressors	7 200	14 600	21 800
- Remaining Electrical	4 750	4 750	9 500
Chemicals	22 500	22 500	45 000
Gas Production*	(25 000)	(11 100)	(36 900)
Net O&M Cost	37 200	58 500	94 900

* Gas Production assumes 60 percent removal of COD at design load for fixed-film reactor and 85 percent removal of COD at 30 percent of design COD load for sludge blanket reactor.

theoretical fuel value rather than a credit based on measured decreases in fuel oil consumption.

Gas productions were calculated for a hypothetical year in which the fixed-film reactor operated steadily at the design COD load and at 60 percent COD removal. Calculations for the sludge bed system were based on 85 percent COD removal at 30 percent design load. This is roughly the best sustained loading/performance achieved in the UASB system to the end of the formal test period in November 1984 although the system reportedly has operated at higher loadings briefly since this period.

The O&M costs were divided evenly between the two anaerobic systems in the table except for the power cost for the aeration compressors. Two thirds of the cost in this case was assigned to the UASB system as the low load to the anaerobic reactor caused some of the equalized effluent to bypass directly to the aerated basins. The estimated power costs for the compressor assumed that both the duty compressor and the standby unit were operated continuously.

Understandably, the O&M costs for the UASB portion of the treatment system are not very attractive for the loadings used in the example. The value of the gas generated during treatment is only half as much as the cost of chemicals for maintaining pH in the equalization basin. Chemical neutralization would be unnecessary in an aerated

basin treatment system and should be much lower for low rate activated sludge. Generally speaking, however, the dairy effluent should have sufficient natural buffering capacity to avoid the need for additional chemical buffering with lime and hydrochloric acid. Further refinements in managing dairy discharges and spills and in pH controls at the reactors may still be able to affect a substantial reduction in chemical costs.

SUMMARY AND CONCLUSIONS

Effluent Treatability. The plant wastewater at Bon Conseil contains a complex mixture of filterable and suspended organic substances including significant quantities of carbohydrates, fats, volatile acids and protein/amino acids. The full-scale performance evaluation demonstrated that anaerobic treatment can remove up to 90 percent of the total COD from this wastewater.

The suspended solids in the equalized wastewater account for up to 40 percent of the total COD load. This COD was removable by anaerobic treatment given suitable hydraulic residence time to provide for hydrolysis and subsequent conversion to methane. This process was incomplete when the estimated HRT was 6 hours and less (e.g., fixed-film reactor at design hydraulic load and 50 percent or greater inactive volume). Reduction of influent suspended solids was much more complete when the system residence time was 40 hours or more (e.g., UASB system at 30 to 40 percent of design load).

Generally, the wastewater contained sufficient ammonia nitrogen to allow natural buffering to pH 7 during anaerobic treatment. Acid and caustic feed systems were essential to counter the effects of periodic spills in the plant but the annual chemical consumption was small.

The fats in the wastewater caused some difficulties as they accumulated at the liquid surfaces in the gas hoods of the UASB and in the gas dome of the fixed-film reactor. Anaerobic degradation of this material is a slow process.

Pretreatment. The equalization tank at Bon Conseil proved to be an important feature of the anaerobic treatment process. It provided the necessary time to allow a relatively high degree of hydrolysis and acetogenesis as volatile acids accounted for 45 percent of the filterable COD in the equalized wastewater. The combined effect of the equalization basin and pH control system was effective in minimizing reactor upsets from load variations in the case of the fixed-film reactor. This was not the case for the UASB process. Spills of whey and whole milk and regular production variations routinely caused a doubling or even tripling of COD and volatile acid concentration in the basin. It was reported that the sludge bed reactor operation was not stable under these conditions except when operating at a very low average load even when effective pH control was maintained.

Operating experience demonstrated that small volume tanks for caustic and acid storage were inadequate to provide the required chemical quantities during significant pH upsets. The addition of the outside acid storage tank and a silo for hydrated lime provided the necessary chemical inventory. The pH in the equalization basin was effectively controlled within a relatively narrow range once these systems were in place.

Fixed-film Reactor. The fixed-film reactor initially achieved COD removals above 60 percent with periods at or above 70 percent close to the design loading range of 5 kg COD/m^3·d (6.7 kg COD/m^3·d based on initial void volume). In this respect, the performance met the design objectives. Day to day reactor stability measured as gas production, pH, volatile acids, and alkalinity was generally good throughout most of the test period. The reactor proved to be superior to the UASB system as its operation was unaffected by variations in pH and COD concentration in the equalized wastewater.

Tracer analyses demonstrated that short circuiting due to media plugging increased throughout the 24 months that the process was monitored. The data showed that 60 percent of the initial reactor volume had become inactive after 18 months of operation. This effectively reduced the actual reactor HRT to less than 5 hours at the design hydraulic load which was reflected in decreased COD removals (50 percent and less) and poor degradation of the influent suspended solids.

The final tracer analysis was completed after scouring with the recirculation gas blower which would suggest that this method of media cleaning is ineffective.

The arrangement of the clay media blocks inside the reactor created less than perfect continuous vertical channels as originally intended. It is not possible to state whether the severe plugging problem would have been avoided if perfect vertical alignment had been achieved. It is highly probable however, that some significant reduction of active reactor volume would have occurred regardless of the method of media alignment judging from the film development observed on the blocks.

The fixed-film reactor cannot be considered a successful anaerobic treatment system in its present configuration.

UASB Reactor. The UASB reactor showed that it could be started-up rapidly given sufficient initial seed sludge from an existing UASB plant. Total COD removals of 80 percent and significant gas production were achieved within 4 to 6 weeks of initial start-up at loadings approaching 50 percent of the design values. The reactor achieved 80 to 90 percent total COD removal including degradation of the majority of the influent

suspended solids throughout the performance evaluation. The design loading of 6.7 kg COD/m^3•d was not achieved, however, owing to difficulties in accumulating a sufficient sludge bed volume. Rapid variations in COD concentration, volatile acids or pH in the equalization basin appeared to disrupt the ability of the sludge to settle. Solids accumulated over several weeks or even months of relatively stable operation could be lost during upsets caused by large spills of whey in the plant.

The concentration of suspended solids in the treated anaerobic effluent generally varied between 200 and 400 mg/L. Assuming that 50 percent of this was anaerobic sludge solids the net continuing loss of anaerobic sludge would have been 100 to 200 mg/L. This was approximately equal to the net sludge production (150 mg/L) assuming 85 percent COD removal and a yield of 0.05 kg TSS/kg COD removed. Even at double the yield (0.10 kg TSS/kg COD) the sludge production would only slightly exceed the losses. On this basis, it would require several months of operation at 50 percent of the design load to increase the sludge inventory by 1 metre. It was reported that this rate of sludge accumulation was maintained only once between November, 1984 and March, 1985. At that time the reactor load had been increased to approximately 4 kg COD/m^3•d and total COD removal was between 70 and 75 percent. Subsequent problems lead to loss of bed volume.

It is probable that sludge build-up in the UASB reactor will be inconsistent as long as the concentration of TSS in the reactor overflow remains high and as long as large day to day variations in the COD concentrations in the equalization basin continue. The presence of 200 to 300 mg/L of fats in the equalized wastewater may be contributing to the high solids carryover, but this is speculative. Some UASB systems are operated on the principle of a constant upflow velocity, within certain limits, using recycle and/or variable volume equalization tanks in order to maintain uniform mixing and turbulence in the sludge bed. Augmentation and control through recycle was implemented during May and part of June in 1984 but the COD loading to the reactor at the time was very low. There was no noticeable improvement in effluent TSS.

Difficulty in achieving low effluent TSS does not appear to be related to the ability to create a heavy granular sludge in the anaerobic reactors. Sludge samples contained a 40 percent non-volatile component most of which was accounted for by calcium carbonate.

APPENDIX 1

SUMMARY OF SYSTEM DESIGN

APPENDIX 1 SUMMARY OF SYSTEM DESIGN

WASTEWATER CHARACTERISTICS

FLOW	mean design	1600 m^3/d
	daily maximum	2200 m^3/d
COD	mean value	5500 kg/d
		3400 mg/L
	maximum value	10 100 kg/d
		6300 mg/L
BOD_5	mean value	2700 kg/d
		1700 mg/L
	maximum value	4700 kg/d
		2900 mg/L
Suspended Solids	mean	700 mg/L
pH	range	2 to 11
Temperature	summer	30°C
	winter	30°C

EQUALIZATION BASIN

Volume		800 m^3
Retention		12 h

FIXED-FILM REACTOR

Volume	empty	550 m^3
	void with media	410 m^3
Retention	initial void basis	12 h
COD Load	empty reactor basis	5.0 $kg/m^3 \cdot d$
	initial void basis	6.7 $kg/m^3 \cdot d$
COD Removal		70%
Clay Tiles	total surface	24 000 m^2
Initial Reactor	surface to volume	44 m^2/m^3
Reactor Dimensions		8.5 x 10.0 x 6.5 m deep

UASB REACTOR

Volume	empty	413 m^3
Retention		12 h
COD Load		6.7 $kg/m^3 \cdot d$
COD Removal		70%
Reactor Dimensions		7.0 x 10.0 x 5.9 m deep

UASB SLUDGE HOLDING TANK

Volume		200 m^3
Retention		6 h
Dimensions		3.5 x 10.0 x 5.5 m deep

AERATION FOR POLISHING

COD	load	1650 kg/d
COD:BOD_5 Ratio		4:1
BOD_5	load	410 kg/d
Blowers		30 kW 2 units (1 duty, 1 study)

AERATED POLISHING BASIN NO. 1

Volume	12 700 m^3
Depth	3.5 m
Air Flow to Cell 1	850 Nm^3/h
Air Flow to Cell 2	340 Nm^3/h
Retention	7.9 h

AERATED POLISHING BASIN NO. 2

Volume	12 700 m^3
Depth	3.5 m
Air Flow	306 Nm^3/h
Retention	7.9 h

SETTLING BASINS (2)

Volume (ea)	2600 m^3
Depth	3.5 m
Retention	1.6 d

APPENDIX 2

FIXED-FILM REACTOR: PERFORMANCE AND OPERATING RECORDS

REACTOR: FIXED FILM PERFORMANCE DATA Page 1 MONTH:APR/MAY 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
		Added anaerobic digester sludge previous week. Upflow mode of operation to end Dec 83.													
		Calculations based on reactor volume of 550 cubic meters. Initial void volume was 410 m^3 (75%).													
18/04	M	50													
	Tu	48	2740		1030		0.24		0.15	62					
	W	94	2240	3440	852		0.38	0.59	0.24	62					
	Th	100	1370	2530	633		0.25	0.46	0.13	54					
	F	113	1750	2700	434		0.36	0.55	0.27	75			71	0.48	
	Sa	77											99		
	Su	0											88		
	AVG	69	2025	2890	737		0.25	0.36	0.16	64			86	0.97	
		Neutralizing system-, pH control, not very reliable.													
25/04	M	64	893	1810	491		0.10	0.21	0.05	45	0.21		69	2.68	0.60
	Tu	66	1140	1960	380		0.14	0.24	0.09	67	0.24		69	1.38	0.53
	W	264	1280	1420	622	1330	0.61	0.68	0.32	51	0.04	6	96	0.55	4.04
	Th	250	1280	2440	693	1380	0.58	1.11	0.27	46	0.48	43	102	0.70	0.38
	F	255	1570	2550	1110	1770	0.73	1.18	0.21	29	0.36	31	109	0.93	0.55
	Sa	250											123		
	Su	250											123		
	AVG	200	1233	2036	659	1493	0.45	0.74	0.21	47	0.20	27	99	0.86	0.91
		Feed interupted for periods on 20 April and 1 May due to pH in basin greater than 8.0.													
02/05	M	30	991	1810	722	1170	0.05	0.10	0.01	27	0.03	35	123	15.24	6.41
	Tu	311	1170	2100	646	1040	0.66	1.19	0.30	45	0.60	50	137	0.84	0.42
	W	299	1320	2170	742	1210	0.72	1.18	0.31	44	0.52	44	116	0.67	0.40
	Th	339	1630	2420	827	1520	1.00	1.49	0.49	49	0.55	37	140	0.51	0.46
	F	273	3690	3690	866	1490	1.83	1.83	1.40	77	1.09	60	133	0.17	0.22
	Sa	343											141		
	Su	0											114		
	AVG	228	1760	2438	761	1286	0.73	1.01	0.41	57	0.48	47	129	0.57	0.49
		Feed interrupted on Sunday 8 May as basin pH greater than 8.0.													

REACTOR: FIXED FILM — PERFORMANCE DATA — Page 2 — MONTH:MAY 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
09/05	M	349	1380	2290	556	785	0.88	1.45	0.52	60	0.95	66	114	0.40	0.22
	Tu	343	718	1170	179	502	0.45	0.73	0.34	75	0.42	57	96	0.52	0.42
	W	245	2310	2930	622	790	1.03	1.31	0.75	73	0.95	73	89	0.22	0.17
	Th	312	1570	2700	811	1250	0.89	1.53	0.43	48	0.82	54	123	0.52	0.27
	F	318	1360	2350	982	1430	0.79	1.36	0.22	28	0.53	39	136	1.13	0.46
	Sa	290											141		
	Su	290											141		
	AVG	307	1468	2288	630	951	0.82	1.28	0.47	57	0.75	58	120	0.47	0.29
	Spill 5 cubic meters of milk on 17/05. COD increased temporarily from 2440 to 4630 mg/L.														
16/05	M	290	1110	1500	520	784	0.59	0.79	0.31	53	0.38	48	141	0.82	0.68
	Tu	304	1800	2440	564	833	0.99	1.35	0.68	69	0.89	66	112	0.30	0.23
	W	324	2290	3670	1060	1520	1.35	2.16	0.72	54	1.27	59	147	0.37	0.21
	Th	342	1700	2870	1280	2040	1.06	1.78	0.26	25	0.52	29	156	1.09	0.55
	F	332	1530	2370	860	2300	0.92	1.43	0.40	44	0.04	3	146	0.66	6.28
	Sa	340											154		
	Su	7											138		
	AVG	277	1686	2570	857	1495	0.85	1.29	0.42	49	0.54	42	142	0.62	0.48
23/05	M	0											92		
	Tu	12											51		
	W	152	2360	3260	502		0.65	0.90	0.51	79	0.90	100	79	0.28	0.16
	Th	66	3620	5480	630		0.43	0.66	0.36	83	0.66	100	35	0.18	0.10
	F	360	2940	4350	1690	2050	1.92	2.85	0.82	43	1.51	53	87	0.19	0.11
	Sa	0											74		
	Su	0											86		
	AVG	84	2973	4363	941	2050	0.46	0.67	0.31	68	0.35	53	72	0.42	0.37

REACTOR: FIXED FILM — PERFORMANCE DATA — Page 3 — MONTH:MAY/JUNE 03

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
30/05	M	47											101		
	Tu	105	1800	2950	1070	1270	0.34	0.56	0.14	41	0.32	57	97	1.27	0.55
	W	205	1880	3130	876	1190	0.70	1.17	0.37	53	0.72	62	28	0.14	0.07
	Th	297	1380	2120		1060	0.75	1.14	0.75	100	0.57	50	14	0.03	0.04
	F	379											107		
	Sa	174											99		
	Su	170											109		
	AVG	197	1687	2733	973	1173	0.60	0.98	0.26	42	0.56	57	79	0.56	0.26

Repaired gas meter on June 2 because of poor initial installation.
Caustic soda replaced with calcium hydroxide for pH control. Feed pumps set to shut if pH > 9 or < 6.

06/06	M	157	1600	2200	600	820	0.46	0.63	0.29	63	0.39	63	96	0.61	0.44
	Tu	192											28		
	W	313	2200	2770	738	1280	1.25	1.58	0.83	66	0.85	54	100	0.22	0.21
	Th	385	2000	3170	1240	1900	1.40	2.22	0.53	38	0.89	40			
	F	515					0.00	0.00	0.00		0.00		127		
	Sa	296					0.00	0.00	0.00		0.00		130		
	Su	359					0.00	0.00	0.00		0.00		125		
	AVG	317	1933	2713	859	1333	1.11	1.56	0.62	56	0.79	51	87	0.25	0.20

Gas volumes are minimums as some gas was escaping from pressure relief valves.

13/06	M	245	565	351	1130	430	0.25	0.16	-0.25	-100	-0.04	-23	156	-1.13	-8.06
	Tu	424	450	273	1130	430	0.35	0.21	-0.52	-151	-0.12	-58	142	-0.49	-2.13
	W	373	360	102	624	325	0.24	0.07	-0.18	-73	-0.15	-219	131	-1.33	-1.57
	Th	394	565	339	682	330	0.40	0.24	-0.08	-21	0.01	3	166	-3.60	46.81
	F	493	555	330	880	555	0.50	0.30	-0.29	-59	-0.20	-68	153	-0.95	-1.38
	Sa	197											154		
	Su	265											170		
	AVG	342	499	279	889	414	0.31	0.17	-0.24	-78	-0.08	-48	153	-1.15	-3.32

Loading calculations for week 13/06 are unreliable owing to odd analytical data.

REACTOR: FIXED FILM PERFORMANCE DATA Page 4 MONTH: JUNE/JULY 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
20/06	M	159	1660	2670	638	1680	0.48	0.77	0.30	62	0.29	37	181	1.11	1.15
	Tu	424	2100	3000	1050	1920	1.62	2.31	0.81	50	0.83	36	169	0.38	0.37
	W	475	1360	2300	1050	1680	1.17	1.99	0.27	23	0.54	27	115	0.78	0.39
	Th	432	740	1070	600	1200	0.58	0.84	0.11	19	-0.10	-12	174	2.88	-3.10
	F	183											45		
	Sa	193											159		
	Su	193											159		
	AVG	294	1465	2260	835	1620	0.78	1.21	0.34	43	0.34	28	143	0.77	0.76
27/06	M	193	1840	3590	925	1160	0.65	1.26	0.32	50	0.85	68	159	0.90	0.34
	Tu	238	2100	3330	863	1260	0.91	1.44	0.54	59	0.90	62	75	0.25	0.15
	W	461	2040	2870	1280	1800	1.71	2.41	0.64	37	0.90	37	141	0.40	0.29
	Th	394	1300	2100	813	1460	0.93	1.50	0.35	37	0.46	30	150	0.78	0.59
	F	561											79		
	Sa	449											1		
	Su	473											10		
	AVG	396	1820	2973	970	1420	1.31	2.14	0.61	47	1.12	52	88	0.26	0.14
04/07	M	469	1080	2970	1030	1880	0.92	2.53	0.04	5	0.93	37	149	6.35	0.29
	Tu	508	1240	3070	869	1740	1.15	2.84	0.34	30	1.23	43			
	W	489	1160	2430	1200	1800	1.03	2.16	-0.04	-3	0.56	26	123	-6.29	0.40
	Th	490	1540	2830	963	1640	1.37	2.52	0.51	37	1.06	42	145	0.51	0.25
	F	525	1680	3370	1260	2020	1.60	3.22	0.40	25	1.29	40	187	0.85	0.26
	Sa	513											150		
	Su	565											174		
	AVG	508	1340	2934	1064	1816	1.24	2.71	0.25	21	1.03	38	155	1.10	0.27

Started recycle pump on 8 July and ran to 9 Nov. Temporary disconnection of gas meter on Tuesday 5 July to check it.

REACTOR: FIXED FILM PERFORMANCE DATA Page 5 MONTH:JULY 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL.)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
11/07	M	499	860	1880	1290	2000	0.78	1.71	-0.39	-50	-0.11	-6	148	-0.69	-2.47
	Tu	0													
	W	43													
	Th	340	2010	2630	781	1270	1.24	1.63	0.76	61	0.84	52	0		
	F	339	2240	3870	1330	2240	1.38	2.39	0.56	41	1.00	42	0		
	Sa	463											120		
	Su	0											163		
	AVG	241	1703	2793	1134	1837	0.75	1.22	0.25	33	0.42	34	86	0.63	0.37

Caustic spill of 1.8 cubic meters on 7 July caused upset for minimum of 3 days.

18/07	M	296	1600	2500	920	1700	0.86	1.35	0.37	43	0.43	32	171	0.85	0.72
	Tu	532	1300	1800	1050	1300	1.26	1.74	0.24	19	0.48	28	200	1.50	0.75
	W	563	1800	2850	1480	1800	1.84	2.92	0.33	18	1.07	37	140	0.78	0.24
	Th	615	1800	3100	1740	2150	2.01	3.47	0.07	3	1.06	31	156	4.23	0.27
	F	607											134		
	Sa	345											355		
	Su	345											355		
	AVG	472	1625	2563	1298	1738	1.39	2.20	0.28	20	0.71	32	216	1.40	0.55

25/07	M	449											176		
	Tu	277											193		
	W	0											250		
	Th	0											186		
	F	0											116		
	Sa	0											133		
	Su	0											98		
	AVG	104											162		

Repairs all week to upflow reactor gas domes required shutdown of fixed film.

REACTOR: FIXED FILM PERFORMANCE DATA Page 6 MONTH:AUGUST 83

DATE	DAY	FLOW	CODin		CODout		LOAD				REMOVAL		GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL.)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
01/08	M	0											91		
	Tu	132		2500		613		0.60			0.45	75	152		0.61
	W	118		2760		4580		0.59			-0.39	-66	162		-0.75
	Th	167	2000	3290	300	3050	0.61	1.00	0.52	85	0.07	7	164	0.58	4.09
	F	159	1650	2750	260	700	0.48	0.80	0.40	84	0.59	75	200	0.90	0.61
	Sa	82											133		
	Su	62											113		
	AVG	103	1825	2825	280	2236	0.34	0.53	0.29	85	0.11	21	145	0.91	2.39
	Restarted fixed film reactor with granular sludge added from upflow reactor 2 August.														
08/08	M	15	2050	3250	120	125	0.06	0.09	0.05	94	0.09	96	42	1.45	0.90
	Tu	37	2800	3700	180	1550	0.19	0.25	0.18	94	0.14	58	39	0.40	0.49
	W	189	1950	3450	1020	750	0.67	1.19	0.32	48	0.93	78	129	0.73	0.25
	Th	161	1600	2850	1120	950	0.47	0.83	0.14	30	0.56	67	178	2.30	0.58
	F	173	1900	3150	1200	475	0.60	0.99	0.22	37	0.84	85	161	1.33	0.35
	Sa	126											145		
	Su	39											95		
	AVG	106	2060	3280	728	770	0.40	0.63	0.26	65	0.48	77	113	0.80	0.42
15/08	M	86	3500	4930	480	575	0.55	0.77	0.47	86	0.68	88	99	0.38	0.26
	Tu	134	1600	2850	280	575	0.39	0.69	0.32	83	0.55	80	163	0.92	0.53
	W	105	1400	2530	190	300	0.27	0.48	0.23	86	0.43	88	116	0.91	0.50
	Th	184	1430	2380	220	375	0.48	0.80	0.40	85	0.67	84	122	0.55	0.33
	F	95	5350	5400	170	275	0.92	0.93	0.89	97	0.89	95	130	0.26	0.27
	Sa	150											224		
	Su	40											115		
	AVG	113	2656	3618	268	420	0.55	0.75	0.49	90	0.66	88	138	0.51	0.38

REACTOR: FIXED FILM PERFORMANCE DATA Page 7 MONTH:AUG/SEPT 83

DATE	DAY	FLOW	CODin		CODout		LOAD			REMOVAL			GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total		Filt		Total		(ACTUAL VOL)	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
22/08	M	0													
	Tu	90	1700	2550	160	250	0.28	0.42	0.25	91	0.38	90	30	0.22	0.14
	W	153	1500	2550	280	450	0.42	0.71	0.34	81	0.58	82	76	0.41	0.24
	Th	282	1880	3250	580	875	0.96	1.67	0.67	69	1.22	73	6	0.02	0.01
	F	102	5150	5230	475	490	0.96	0.97	0.87	91	0.88	91	284	0.60	0.59
	Sa	148											131		
	Su	138											166		
	AVG	130	2550	3395	374	516	0.61	0.81	0.52	85	0.68	85	116	0.41	0.31
29/08	M	31											102		
	Tu	220											111		
	W	96													
	Th	74											101		
	F	238											134		
	Sa	131											118		
	Su	140											125		
	AVG	133											115		

Gas burner installation 31 August. Inconsistent operation for several months until modifications made.

06/09	M	84											68		
	Tu	84											68		
	W	241											120		
	Th	264											156		
	F	229											162		
	Sa	185											134		
	Su	0											79		
	AVG	155											112		

REACTOR: FIXED FILM PERFORMANCE DATA Page 8 MONTH:SEPT 83

DATE	DAY	FLOW	CODin		CODout		LOAD			REMOVAL			GAS PRODUCTION	
			Filt	Total	Filt	Total	Filt	Total					(ACTUAL VOL)	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
12/09	M	132											149		
	Tu	165											81		
	W	180											99		
	Th	117											81		
	F	117											81		
	Sa	201											102		
	Su	177											134		
	AVG	156											104		
19/09	M	63											113		
	Tu	364											157		
	W	404											185		
	Th	434											197		
	F	488											210		
	Sa	505											222		
	Su	441											204		
	AVG	386											184		
26/09	M	373											185		
	Tu	524											176		
	W	504											209		
	Th	411											214		
	F	436											202		
	Sa	402											241		
	Su	475											209		
	AVG	446											205		

REACTOR: FIXED FILM PERFORMANCE DATA Page 9 MONTH:OCT 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
03/10	M	435											165		
	Tu	415											217		
	W	161											211		
	Th	161											212		
	F	324											275		
	Sa	134											276		
	Su	261											294		
	AVG	270											236		
10/10	M	199											294		
	Tu	293											221		
	W	385											255		
	Th	436											320		
	F	253											355		
	Sa	437											371		
	Su	193											259		
	AVG	314											296		
17/10	M	399											222		
	Tu	444											214		
	W	401											360		
	Th	419											427		
	F	400											446		
	Sa	403											434		
	Su	447											476		
	AVG	416											368		

REACTOR: FIXED FILM PERFORMANCE DATA Page 10 MONTH:OCT/NOV 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
24/10	M	341											300		
	Tu	418													
	W	418													
	Th	443											481		
	F	462											347		
	Sa	434											356		
	Su	14											265		
	AVG	361											350		
31/10	M	246											266		
	Tu	395											290		
	W	497											339		
	Th	513											384		
	F	551											359		
	Sa	449											390		
	Su	442											350		
	AVG	442											340		
7/11	M	442											350		
	Tu	442											350		
	W	390											302		
	Th	209											290		
	F	374											311		
	Sa	391											352		
	Su														
	AVG	375											326		

Stopped recirculation pump 9 Nov.

REACTOR: FIXED FILM PERFORMANCE DATA Page 11 MONTH:NOV 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
14/11	M	582											262		
	Tu	456											251		
	W	522											305		
	Th	601											438		
	F	600											453		
	Sa	504											478		
	Su	225											273		
	AVG	499											351		
21/11	M	212											252		
	Tu	420											365		
	W	384											530		
	Th	565											532		
	F	584											486		
	Sa	549											236		
	Su	537											136		
	AVG	464											362		
28/11	M	650	4000	5150	735	1125	4.73	6.09	3.86	82	4.76	78			
	Tu	805	1770	3550	783	1430	2.59	5.20	1.44	56	3.10	60	462	0.58	0.27
	W	615	1720	2600	470	885	1.92	2.91	1.40	73	1.92	66	424	0.55	0.40
	Th	673	2470	3380	865	1220	3.02	4.14	1.96	65	2.64	64	454	0.42	0.31
	F	749	2150	3300	510	1270	2.93	4.49	2.23	76	2.76	62	435	0.35	0.29
	Sa	737											576		
	Su	796											491		
	AVG	718	2422	3596	673	1186	3.16	4.69	2.28	72	3.15	67	474	0.38	0.27

Repaired defective gas meter 28 Nov.

REACTOR: FIXED FILM PERFORMANCE DATA Page 12 MONTH:DEC 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL			GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d) (%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
05/12	M	862										350		
	Tu	851										345		
	W	793										402		
	Th	704										411		
	F	744										258		
	Sa	841										480		
	Su	433										362		
	AVG	747										373		
	First attempt to burn gas at boiler on 6-7 Dec.													
12/12	M	978										244		
	Tu	837										283		
	W	931										472		
	Th	680										683		
	F	631										656		
	Sa	746										675		
	Su	824										719		
	AVG	804										533		
	Whey spill of 82 cubic meters on 14 Dec.													
19/12	M	685		10400				12.95			12.95 100	979		0.14
	Tu	686	3280	6300	3020	3890	4.09	7.86	0.32	8	3.01 38	330	1.85	0.20
	W	873	2230	3600	1330	2600	3.54	5.71	1.43	40	1.59 28	678	0.86	0.78
	Th	991	1930	2830	950	2050	3.48	5.10	1.77	51	1.41 28	547	0.56	0.71
	F	971	2680	4600	1100	2530	4.73	8.12	2.79	59	3.65 45	575	0.37	0.29
	Sa	939										627		
	Su	780										432		
	AVG	846	2530	5546	1600	2768	3.89	8.54	1.43	37	4.28 50	595	0.76	0.25
	Whey spill of 300 cubic meters on 19 Dec.													

REACTOR: FIXED FILM PERFORMANCE DATA Page 13 MONTH:DEC 83/JAN 84

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
26/12	M	918											306		
	Tu	772	1290	2960	425	1030	1.81	4.15	1.21	67	2.71	65	200	0.30	0.13
	W	963	1930	2980	788	1810	3.38	5.22	2.00	59	2.05	39	344	0.31	0.31
	Th	1132	1070	2100	488	1100	2.20	4.32	1.20	54	2.06	48	415	0.63	0.37
	F	1187	906	1950	383	1050	1.96	4.21	1.13	58	1.94	46	349	0.56	0.33
	Sa	976											407		
	Su	1084											301		
	AVG	1005	1299	2498	521	1248	2.37	4.56	1.42	60	2.28	50	332	0.42	0.26
02/01	M	688											301		
	Tu	974	2400	3850	975	2000	4.25	6.82	2.52	59	3.28	48	294	0.21	0.16
	W	611	2310	3630	725	1530	2.57	4.03	1.76	69	2.33	58	495	0.51	0.39
	Th	553	1790	3000	525	1030	1.80	3.02	1.27	71	1.98	66	499	0.71	0.46
	F	606	1930	3030	400	800	2.13	3.34	1.69	79	2.46	74	471	0.51	0.35
	Sa	847											571		
	Su	715											256		
	AVG	713	2108	3378	656	1340	2.73	4.38	1.88	69	2.64	60	412	0.40	0.28
	Change to downflow operation 6 Jan.														
09/01	M	661	725	1530	220	475	0.87	1.84	0.61	70	1.27	69	230	0.69	0.33
	Tu	23	1050	2330	125	220	0.04	0.10	0.04	88	0.09	91	176	8.27	3.63
	W	0	900	2100	123	200				86		90	81		
	Th	0	1150	2300	95	150				92		93	12		
	F	0	1200	2500	113	155				91		94	9		
	Sa	0													
	Su	0													
	AVG	98	1005	2152	135	240	0.18	0.38	0.15	87	0.34	89	N.A.	N.A.	N.A.
	Flow stopped at 14:00 hrs 9 Jan.														

REACTOR: FIXED FILM PERFORMANCE DATA Page 14 MONTH:JAN 84

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg COOt)
16/01	M	0											0		
	Tu	168	950	1940	105	180	0.29	0.59	0.26	89	0.54	91	0		
	W	106	1500	2680	130	270	0.29	0.52	0.26	91	0.46	90	0		
	Th	273	1580	2750	125	208	0.78	1.37	0.72	92	1.26	92	112	0.28	0.16
	F	345	1430	2460	303	825	0.90	1.54	0.71	79	1.03	66	0		
	Sa	345											0		
	Su	345											0		
	AVG	226	1365	2458	166	371	0.56	1.01	0.49	88	0.86	85	N.A.	N.A.	N.A.

Operating data for week 16/01 not representative as feed had been turned off previous week and HRT was 2-4 days.

23/01	M	611	437	1150	140	390	0.49	1.28	0.33	68	0.84	66	35	0.19	0.08
	Tu	677	1080	2150	305	680	1.33	2.65	0.95	72	1.81	68	69	0.13	0.07
	W	719	1290	2750	340	823	1.69	3.60	1.24	74	2.52	70	559	0.82	0.40
	Th	687	3000	4450	925	1710	3.75	5.56	2.59	69	3.42	62	825	0.58	0.44
	F	584	3250	5300	772	1430	3.45	5.63	2.63	76	4.11	73	433	0.30	0.19
	Sa	401											21		
	Su	385											83		
	AVG	581	1811	3160	496	1007	1.91	3.34	1.39	73	2.27	68	289	0.38	0.23

The gas meter appeared to be having problems again. Whey spill of 100 cubic meters on 25 Jan affected gas production.

30/01	M	830	1200	2230	240	450	1.81	3.37	1.45	80	2.69	80	153	0.19	0.10
	Tu	824	975	1950	313	655	1.46	2.92	0.99	68	1.94	66	214	0.39	0.20
	W	860	1630	2940	355	830	2.55	4.60	1.99	78	3.30	72	382	0.35	0.21
	Th	835	2290	3780	640	1300	3.48	5.74	2.51	72	3.77	66	456	0.33	0.22
	F	821	1400	2390	430	880	2.09	3.57	1.45	69	2.25	63	431	0.54	0.35
	Sa	781											431		
	Su	764											431		
	AVG	816	1499	2658	396	823	2.23	3.95	1.64	74	2.72	69	357	0.40	0.24

REACTOR: FIXED FILM PERFORMANCE DATA Page 15 MONTH:FEB 84

DATE	DAY	FLOW	CODin		CODout		LOAD			REMOVAL			GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total		Filt		Total		(ACTUAL VOL)	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
6/02	M	797	1725	3025	530	1085	2.50	4.38	1.73	69	2.81	64	433	0.45	0.28
	Tu	812	1813	3013	525	1040	2.68	4.45	1.90	71	2.91	65	402	0.38	0.25
	W	668	1713	3075	533	1065	2.08	3.73	1.43	69	2.44	65	444	0.56	0.33
	Th	663	1913	3475	575	1180	2.31	4.19	1.61	70	2.77	66	490	0.55	0.32
	F	698	1875	3175	635	1330	2.38	4.03	1.57	66	2.34	58	218	0.25	0.17
	Sa	808											0		
	Su	827											24		
	AVG	753	1808	3153	560	1140	2.48	4.32	1.71	69	2.76	64	287	0.31	0.19
13/02	M	816	1513	2525	605	1185	2.24	3.75	1.35	60	1.99	53	413	0.56	0.38
	Tu	780	1775	2925	705	1350	2.52	4.15	1.52	60	2.23	54	401	0.48	0.33
	W	797	1750	2913	615	1213	2.54	4.22	1.64	65	2.46	58	502	0.55	0.37
	Th	803	1700	2913	613	1240	2.48	4.25	1.59	64	2.44	57	619	0.71	0.46
	F	807	3025	4900	770	1440	4.44	7.19	3.31	75	5.08	71	599	0.33	0.21
	Sa	718													
	Su	745													
	AVG	781	1953	3235	662	1286	2.77	4.59	1.83	66	2.77	60	507	0.50	0.33
	Whey spill of 5 cubic meters 17 Feb. New lime system operated 76 minutes.														
20/02	M	652	1750	3300	505	1055	2.07	3.91	1.48	71	2.66	68			
	Tu	727	1050	2150	330	780	1.39	2.84	0.95	69	1.81	64			
	W	783	940	1940	295	680	1.34	2.76	0.92	69	1.79	65			
	Th	777	700	1800	360	800	0.99	2.54	0.48	49	1.41	56	286	1.08	0.37
	F	815	1208	2125	525	1205	1.79	3.15	1.01	57	1.36	43	250	0.45	0.33
	Sa	787											143		
	Su	556											150		
	AVG	728	1130	2263	403	904	1.50	3.00	0.96	64	1.80	60	207	0.39	0.21
	Cheese plant was down for the week starting 18 February thus reducing effluent strength.														

REACTOR: FIXED FILM PERFORMANCE DATA Page 16 MONTH:FEB/MAR 84

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
27/02	M	785	880	1513	163	520	1.26	2.16	1.02	81	1.42	66	83	0.15	0.11
	Tu	795	840	1538	343	685	1.21	2.22	0.72	59	1.23	55	84	0.21	0.12
	W	847	338	1300	183	565	0.52	2.00	0.24	46	1.13	57	75	0.57	0.12
	Th	842	245	1038	158	670	0.38	1.59	0.13	36	0.56	35	66	0.90	0.21
	F	793	425	1120	210	710	0.61	1.61	0.31	51	0.59	37	63	0.37	0.19
	Sa	788											53		
	Su	819											95		
	AVG	810	546	1302	211	630	0.80	1.92	0.49	61	0.99	52	74	0.27	0.14
	Cheese plant still down to 5 March.														
05/03	M	840	515	1020	220	610	0.79	1.56	0.45	57	0.63	40	196	0.79	0.57
	Tu	867	1325	2800	510	1270	2.09	4.41	1.28	62	2.41	55	380	0.54	0.29
	W	844	1835	3200	635	1200	2.82	4.91	1.84	65	3.07	63	563	0.56	0.33
	Th	827	1950	3100	690	1260	2.93	4.66	1.89	65	2.77	59	280	0.27	0.18
	F	822	2325	3800	660	1300	3.47	5.68	2.49	72	3.74	66	740	0.54	0.36
	Sa	823											630		
	Su	780											503		
	AVG	829	1590	2784	543	1128	2.40	4.20	1.58	66	2.50	59	470	0.54	0.34
12/03	M	818	1538	2775	505	1110	2.29	4.13	1.54	67	2.48	60	391	0.46	0.29
	Tu	668	1363	2375	425	920	1.66	2.88	1.14	69	1.77	61	384	0.61	0.40
	W	823	1175	2275	340	690	1.76	3.40	1.25	71	2.37	70	813	1.18	0.62
	Th	822	3800	6000	980	1838	5.68	8.97	4.21	74	6.22	69	942	0.41	0.28
	F	826	2378	3800	625	1225	3.57	5.71	2.63	74	3.87	68	683	0.47	0.32
	Sa	497											513		
	Su	800											754		
	AVG	751	2051	3445	575	1157	2.80	4.70	2.01	72	3.12	66	640	0.58	0.37
	Lime usage of 150 minutes on 15 March.														

REACTOR: FIXED FILM PERFORMANCE DATA Page 17 MONTH:MAR/APR 84

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
19/03	M	804	4500	7000	1220	2500	6.58	10.23	4.79	73	6.58	64	1102	0.42	0.30
	Tu	816	2475	3950	770	1555	3.67	5.86	2.53	69	3.55	61	596	0.43	0.30
	W	611	2075	3650	475	1085	2.31	4.05	1.78	77	2.85	70	564	0.58	0.36
	Th	782	3000	4750	305	1260	4.27	6.75	3.83	90	4.96	73	713	0.34	0.26
	F	786	2070	3600	603	1280	2.96	5.14	2.10	71	3.32	64	638	0.55	0.35
	Sa	695											255		
	Su	349											374		
	AVG	692	2824	4590	675	1536	3.55	5.77	2.70	76	3.84	67	606	0.41	0.29
26/03	M	742	900	2450	345	720	1.21	3.31	0.75	62	2.33	71	380	0.92	0.30
	Tu	727	1335	2650	473	1040	1.76	3.50	1.14	65	2.13	61	231	0.37	0.20
	W	762	1525	2850	500	1020	2.11	3.95	1.42	67	2.54	64	493	0.63	0.35
	Th	751	1663	2575	538	945	2.27	3.52	1.54	68	2.23	63	422	0.50	0.34
	F	645	1775	2675	575	1030	2.08	3.14	1.41	68	1.93	61	388	0.50	0.37
	Sa	434											319		
	Su												83		
	AVG	677	1440	2640	486	951	1.77	3.25	1.17	66	2.08	64	331	0.51	0.29
02/04	M	492	1188	2125	218	480	1.06	1.90	0.87	82	1.47	77	271	0.57	0.33
	Tu	685	2288	3600	145	358	2.85	4.48	2.67	94	4.04	90	332	0.23	0.15
	W	707	2525	3900	475	850	3.25	5.01	2.64	81	3.92	78	481	0.33	0.22
	Th	781	1913	3000	275	565	2.72	4.26	2.33	86	3.46	81	426	0.33	0.22
	F	728	1125	2125	283	555	1.49	2.81	1.11	75	2.08	74	317	0.52	0.28
	Sa	876											515		
	Su	842											479		
	AVG	730	1808	2950	279	562	2.40	3.92	2.03	85	3.17	81	403	0.36	0.23

REACTOR: FIXED FILM PERFORMANCE DATA Page 18 MONTH:APR 84

DATE	DAY	FLOW	CODin		CODout		LOAD			REMOVAL			GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
09/04	M	842	1663	2525	470	870	2.55	3.87	1.83	72	2.53	66	502	0.50	0.36
	Tu	800	1600	2575	430	880	2.33	3.75	1.70	73	2.47	66	558	0.60	0.41
	W	825	2475	3675	540	1060	3.71	5.51	2.90	78	3.92	71	622	0.39	0.29
	Th	677	2275	3575	465	1020	2.80	4.40	2.23	80	3.14	71	513	0.42	0.30
	F	753	1725	2875	295	630	2.36	3.94	1.96	83	3.07	78	433	0.40	0.26
	Sa	755											335		
	Su	775											67		
	AVG	775	1948	3045	440	892	2.75	4.29	2.13	77	3.03	71	433	0.37	0.26
	Cleared flowmeter on 13 April.														
16/04	M	812	1588	2463	455	910	2.34	3.64	1.67	71	2.29	63	547	0.59	0.43
	Tu	916	1800	3075	580	1285	3.00	5.12	2.03	68	2.98	58	636	0.57	0.39
	W	872	2050	3400	610	1310	3.25	5.39	2.28	70	3.31	61	626	0.50	0.34
	Th	852	2088	3300	505	1100	3.23	5.11	2.45	76	3.41	67	654	0.48	0.35
	F	826	2325	3650	473	1010	3.49	5.48	2.78	80	3.96	72	573	0.37	0.26
	Sa	793		3500				5.05			5.05		407		0.15
	Su	657		2225				2.66			2.66		267		0.18
	AVG	818	1970	3088	525	1123	2.93	4.59	2.15	73	2.92	64	530	0.45	0.33
23/04	M	828	900	1900	330	870	1.35	2.86	0.86	63	1.55	54	475	1.01	0.56
	Tu	787	1463	2625	465	1075	2.09	3.76	1.43	68	2.22	59	321	0.41	0.26
	W	704	1125	2025	310	695	1.44	2.59	1.04	72	1.70	66	325	0.57	0.35
	Th	772	1225	2375	230	540	1.72	3.33	1.40	81	2.58	77	432	0.56	0.30
	F	814	2288	3675	505	1220	3.39	5.44	2.64	78	3.63	67	821	0.57	0.41
	Sa	884		3550				5.71			5.71		698		0.22
	Su	907		2950				4.86			4.86		537		0.20
	AVG	814	1400	2729	368	880	2.07	4.04	1.53	74	2.73	68	516	0.61	0.34

Whey spill of 14 cubic meters 23 April at 16:00 hrs plus 16 cubic meters of whole milk on 29 April.

REACTOR: FIXED FILM PERFORMANCE DATA Page 19 MONTH:APR/MAY 84

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
30/04	M	957	2550	5200	590	1320	4.44	9.05	3.41	77	6.75	75	758	0.40	0.20
	Tu	796	2038	3375	530	1130	2.95	4.88	2.18	74	3.25	67	655	0.55	0.37
	W	735	1850	2925	555	1055	2.47	3.91	1.73	70	2.50	64	546	0.57	0.40
	Th	745	1625	2938	348	775	2.20	3.98	1.73	79	2.93	74	559	0.59	0.35
	F	774	1675	2850	345	770	2.36	4.01	1.87	79	2.93	73	432	0.42	0.27
	Sa	753		2950				4.04			4.04		636		0.29
	Su	731		2850				3.79			3.79		435		0.21
	AVG	784	1948	3298	474	1010	2.78	4.70	2.10	76	3.26	69	574	0.50	0.32
	Lime feeding for pH control for 50 minutes during the weekend of 5 and 6 April.														
07/05	M	749	2288	3675	600	1150	3.12	5.00	2.30	74	3.44	69	545	0.43	0.29
	Tu	751	1800	2900	360	750	2.46	3.96	1.97	80	2.94	74	464	0.43	0.29
	W	815	1350	2338	335	700	2.00	3.46	1.50	75	2.43	70	539	0.65	0.40
	Th	802	1544	2475	455	880	2.25	3.61	1.59	71	2.33	64	538	0.62	0.42
	F	786	1213	2038	280	600	1.73	2.91	1.33	77	2.06	71	533	0.73	0.47
	Sa	499		2963				2.69			2.69		599		0.41
	Su	687		3125				3.90			3.90		271		0.13
	AVG	727	1639	2788	406	816	2.17	3.68	1.63	75	2.61	71	498	0.56	0.35
	Caustic spill in the plant between 11:00 pm and midnight on 12 May.														
14/05	M	425	1240	2175	310	710	0.96	1.68	0.72	75	1.13	67	288	0.73	0.46
	Tu	766	925	1950	168	490	1.29	2.72	1.05	82	2.03	75	445	0.77	0.40
	W	785	1750	3025	450	950	2.50	4.32	1.86	74	2.96	69	498	0.49	0.31
	Th	788	1488	2500	465	950	2.13	3.58	1.47	69	2.22	62	426	0.53	0.35
	F	749	1650	2825	345	770	2.25	3.85	1.78	79	2.80	73	588	0.60	0.38
	Sa	706		3013				3.87			3.87		561		0.26
	Su	678		2600				3.21			3.21		281		0.16
	AVG	700	1411	2584	348	774	1.79	3.29	1.35	75	2.30	70	441	0.59	0.35

REACTOR: FIXED FILM PERFORMANCE DATA Page 20 MONTH:MAY/JUNE 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
21/05	M	730	940	1488	260	520	1.25	1.97	0.90	72	1.28	65	288	0.58	0.41
	Tu	673	1625	2325	455	820	1.99	2.84	1.43	72	1.84	65	480	0.61	0.47
	W	763	1275	2600	315	840	1.77	3.61	1.33	75	2.44	68	420	0.57	0.31
	Th	775	1075	1913	300	700	1.51	2.70	1.09	72	1.71	63	487	0.81	0.52
	F	681	1350	2350	335	840	1.67	2.91	1.26	75	1.87	64	537	0.78	0.52
	Sa	749		2525				3.44					412		
	Su	627		1550				1.77							
	AVG	714	1253	2107	333	744	1.63	2.74	1.19	73	1.77	65	437	0.67	0.45
28/05	M	948	940	1525	260	620	1.62	2.63	1.17	72	1.56	59	385	0.60	0.45
	Tu	925	1000	1625	355	620	1.68	2.73	1.08	65	1.69	62	187	0.31	0.20
	W	970	1420	2325	395	840	2.50	4.10	1.81	72	2.62	64	456	0.46	0.32
	Th	694	1335	2350	355	730	1.68	2.97	1.24	73	2.04	69	668	0.98	0.59
	F	889	7750	11750	890	1740	12.53	18.99	11.09	89	16.18	85	2258	0.37	0.25
	Sa	870		4250				6.72					1071		
	Su	854		3225				5.01					722		
	AVG	879	2489	3864	451	910	3.98	6.17	3.26	82	4.72	76	821	0.46	0.32

Whey spill of 185 cubic meters on 1 June caused 408 minutes of lime addition.

04/06	M	890	2088	3225	438	890	3.38	5.22	2.67	79	3.78	72	612	0.42	0.29
	Tu	883	1525	2375	400	790	2.45	3.81	1.81	74	2.54	67	602	0.61	0.43
	W	895	3175	4375	638	1330	5.17	7.12	4.13	80	4.96	70	782	0.34	0.29
	Th	875	1523	2538	418	885	2.42	4.04	1.76	73	2.63	65	397	0.41	0.27
	F	858	1640	2700	353	770	2.56	4.21	2.01	78	3.01	71	767	0.69	0.46
	Sa	832		2975				4.50					563		
	Su	690		3500				4.39					283		
	AVG	846	1990	3098	449	933	3.06	4.77	2.37	77	3.33	70	572	0.44	0.31

A 20 minute spill in the evaporator area on 6 June. Same day grease partially plugged the piping at the flowmeter.

Magnetic flowmeter at raw effluent pump station went on line.

REACTOR: FIXED FILM PERFORMANCE DATA Page 21 MONTH:JUNE 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
11/06	M	573	380	1500	213	780	0.40	1.56	0.17	44	0.75	48	272	2.84	0.66
	Tu	799	820	1800	200	630	1.19	2.61	0.90	76	1.70	65	389	0.79	0.42
	W	831	1035	1900	280	560	1.56	2.87	1.14	73	2.02	71	284	0.45	0.26
	Th	782	1340	2150	260	575	1.91	3.06	1.54	81	2.24	73	336	0.40	0.27
	F	814	1265	2275	315	715	1.87	3.37	1.41	75	2.31	69			
	Sa	784		3038				4.33					567		
	Su	787		3400				4.87					481		
	AVG	767	968	2295	254	652	1.35	3.20	1.00	74	2.29	72	388	0.71	0.31
18/06	M	808	1150	1975	298	670	1.69	2.90	1.25	74	1.92	66	473	0.69	0.45
	Tu	807	1588	2750	343	850	2.33	4.04	1.83	78	2.79	69	396	0.39	0.26
	W	787	1420	2400	420	870	2.03	3.43	1.43	70	2.19	64	644	0.82	0.54
	Th	752	2375	3550	503	1040	3.25	4.85	2.56	79	3.43	71	666	0.47	0.35
	F	712	2325	3425	435	950	3.01	4.43	2.45	81	3.20	72	662	0.49	0.38
	Sa	728		3150				4.17					544		
	Su	714		2325				3.02					502		
	AVG	758	1772	2796	400	876	2.44	3.86	1.89	77	2.65	69	555	0.53	0.38
25/06	M	733	2000	3550	370	930	2.67	4.73	2.17	82	3.49	74	316	0.26	0.16
	Tu	789	1850	3150	245	790	2.65	4.52	2.30	87	3.39	75	546	0.43	0.29
	W	756	1600	2900	283	790	2.20	3.98	1.81	82	2.90	73	421	0.42	0.26
	Th	524	1485	3575	270	820	1.41	3.40	1.16	82	2.62	77	354	0.56	0.25
	F	765	1588	3575	165	460	2.21	4.97	1.98	90	4.33	87	548	0.50	0.23
	Sa	735		3650				4.88					573		
	Su	684		2800				3.48					423		
	AVG	712	1705	3314	267	758	2.21	4.29	1.86	84	3.31	77	454	0.44	0.25

REACTOR: FIXED FILM PERFORMANCE DATA Page 22 MONTH:JULY 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
02/07	M	704		3000				3.84					437		
	Tu	660		3000				3.60					472		
	W	728		2550				3.38							
	Th	692	1670	2800	280	615	2.10	3.52	1.75	83	2.75	78	547	0.57	0.36
	F	1077		3300		880		6.46			4.74	73	749		
	Sa	564		2900		960		2.97			1.99	67	566		
	Su	758		3400		830		4.69			3.54	76	427		
	AVG	740	1670	2993	280	821	2.25	4.03	1.87	83	2.92	73	533	0.52	0.33

Gas valve for 4 July low because of leakage. Not counted in average for week.

09/07	M	1351		2350		1220		5.77			3.78	48	771		0.51
	Tu	1343		3400		1200		8.30			5.37	65	877		0.30
	W	1347		2500		1560		6.12			2.30	38	679		0.54
	Th	1273		2500		720		5.79			4.12	71	423		0.19
	F	1226		3400		1480		7.58			4.28	56	758		0.32
	Sa	537		3300		1520		3.22			1.74	54	534		0.56
	Su	794											411		
	AVG	1124		2908		1283		5.95			3.32	56	636		0.35

Two pumps feeding reactor starting 9 July. Equalizing basin has no overflow from now to later in the fall.

16/07	M	1263	1820	2950	730	1420	4.18	6.77	2.50	60	3.51	52	557	0.40	0.29
	Tu	1273	1825	3050	625	1300	4.22	7.06	2.78	66	4.05	57	656	0.43	0.29
	W	1161	1488	2563	670	1360	3.14	5.41	1.73	55	2.54	47	586	0.62	0.42
	Th	1244	1600	2600	810	1440	3.62	5.88	1.79	49	2.62	45	638	0.65	0.44
	F	1157	1375	2450	630	1260	2.89	5.15	1.57	54	2.50	49	823	0.95	0.60
	Sa	740		6800	2120	4000		9.14			3.76	41	1142		0.55
	Su	828		5800		2210		8.73			5.41	62	936		0.31
	AVG	1095	1622	3745	931	1856	3.23	7.46	1.38	43	3.76	50	763	1.01	0.37

Lime feed operated 296 minutes on Saturday 21 July.

REACTOR: FIXED FILM PERFORMANCE DATA Page 23 MONTH: JULY/AUGUST 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total			(ACTUAL VOL)	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
23/07	M	1156	1788	3025	900	1795	6.36	6.36	4.47	70	2.59	41	651	0.26	0.46
	Tu	1298	1850	3150	700	1560	7.43	7.43	5.78	78	3.75	50	626	0.20	0.30
	W	1468	1540	2800	780	1660	7.47	7.47	5.39	72	3.04	41	755	0.25	0.45
	Th	1291	3050	5300	1440	2200	12.44	12.44	9.06	73	7.28	58	940	0.19	0.23
	F	1204	1813	3250	800	1760	7.11	7.11	5.36	75	3.26	46	822	0.28	0.46
	Sa	693		3850				4.85					740		
	Su	824		4400				6.60					639		
	AVG	1133	2008	3682	924	1795	4.14	7.59	2.23	54	3.89	51	739	0.60	0.35
	Lime operated 36 minutes Thursday 26 July. No spill reported.														
30/07	M	1269	1600	2950	840	1840	3.69	6.80	1.75	48	2.56	38	557	0.58	0.40
	Tu	1060	1800	3200	700	1560	3.47	6.17	2.12	61	3.16	51	667	0.57	0.38
	W	1247	2000	3600	760	1840	4.53	8.16	2.81	62	3.99	49	747	0.48	0.34
	Th	1214	1930	3500	900	2040	4.26	7.72	2.27	53	3.22	42	847	0.68	0.48
	F	1266	1963	3275	780	1730	4.52	7.54	2.72	60	3.56	47	946	0.63	0.48
	Sa	589											675		
	Su	1255											624		
	AVG	1128	1859	3305	796	1802	3.81	6.78	2.18	57	3.08	45	723	0.60	0.43
06/08	M	1154	2325	3700	1060	2150	4.88	7.76	2.65	54	3.25	42	691	0.47	0.39
	Tu	1162	1650	2775	620	1450	3.49	5.86	2.18	62	2.80	48	350	0.29	0.23
	W	1037	1763	3200	800	1713	3.32	6.03	1.82	55	2.80	46	665	0.67	0.43
	Th	1063	1613	3075	800	1575	3.12	5.94	1.57	50	2.90	49	728	0.84	0.46
	F	1254	1850	3300	570	1475	4.22	7.53	2.92	69	4.16	55	843	0.53	0.37
	Sa	613		3950				4.40					679		
	Su	764		4575				6.36					572		
	AVG	1007	1840	3511	770	1673	3.37	6.43	1.96	58	3.36	52	647	0.60	0.35

REACTOR: FIXED FILM PERFORMANCE DATA Page 24 MONTH:AUGUST/SEPT 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
13/08	M	1274	1750	2963	950	1800	4.05	6.86	1.85	46	2.69	39	642	0.63	0.43
	Tu	1213	1575	2925	840	1775	3.47	6.45	1.62	47	2.54	39	708	0.79	0.51
	W	1096	2000	3550	1020	2088	3.99	7.08	1.95	49	2.91	41	652	0.61	0.41
	Th	1100	2475	3650	1110	2375	4.95	7.30	2.73	55	2.55	35	649	0.43	0.46
	F	1344	1963	3100	950	1638	4.80	7.58	2.48	52	3.57	47	361	0.27	0.18
	Sa	615		3000				3.36					0		
	Su	843		4600				7.05					141		
	AVG	1069	1953	3398	974	1935	3.80	6.61	1.90	50	2.84	43	450	0.43	0.29
20/08	M	1466	1950	3600	960	1925	5.20	9.60	2.64	51	4.46	47	655	0.45	0.27
	Tu	1097	2225	3650	1220	2263	4.44	7.28	2.01	45	2.77	38	574	0.52	0.38
	W	1176	2000	3525	1000	1975	4.28	7.54	2.14	50	3.32	44	543	0.46	0.30
	Th	1213	1600	2725	930	1800	3.53	6.01	1.48	42	2.04	34	77	0.09	0.07
	F	1206	1520	3050	940	1675	3.33	6.69	1.27	38	3.02	45	190	0.27	0.11
	Sa	1059		3125				6.01					475		
	Su	1145		3400				7.08					92		
	AVG	1195	1859	3296	1010	1928	4.04	7.16	1.84	46	2.97	42	372	0.37	0.23
	Lime feed operated 95 minutes on Thursday and Friday, 30 and 31 August.														
27/08	M	1182	1400	2500	720	1375	3.01	5.37	1.46	49	2.42	45	66	0.08	0.05
	Tu	1112	1800	3100	1060	2150	3.64	6.27	1.50	41	1.92	31	399	0.48	0.38
	W	1197	1725	2900	960	1750	3.75	6.31	1.67	44	2.50	40	65	0.07	0.05
	Th	1285	2800	4550	950	1925	6.54	10.63	4.32	66	6.13	58			
	F	1202	2200	3550	1280	2300	4.81	7.76	2.01	42	2.73	35			
	Sa	683		4800				5.96							
	Su	742		3200				4.32							
	AVG	1058	1985	3514	994	1900	3.82	6.76	1.91	50	3.10	46	177	0.17	0.10
	Gas meter was disconnected for repair/cleaning on 30 August due to erratic readings.														

REACTOR: FIXED FILM PERFORMANCE DATA Page 25 MONTH:SEPT 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
03/09	M	1210													
	Tu	1102	2125	3450	1140	2100	4.26	6.91	1.97	46	2.70	39			
	W	957	1975	4050	1220	2525	3.44	7.05	1.31	38	2.65	38			
	Th	1009	1800	3350	1060	2125	3.30	6.14	1.36	41	2.25	37			
	F	941	1900	3525	920	1975	3.25	6.03	1.68	52	2.65	44			
	Sa	327		3250				1.93							
	Su	175		3750				1.19							
	AVG	817	1950	3563	1085	2181	2.90	5.29	1.28	44	2.05	39	454	0.64	0.40
10/09	M	277	1482	2650	320	750	0.75	1.34	0.59	78	0.96	72			
	Tu	281	1380	3175	380	840	0.70	1.62	0.51	72	1.19	74			
	W	391	1355	3175	530	1420	0.96	2.26	0.59	61	1.25	55			
	Th	409	1420	3175	580	1360	1.05	2.36	0.62	59	1.35	57			
	F	410	2100	3450	660	1290	1.57	2.57	1.07	69	1.61	63			
	Sa	396		3350				2.41							
	Su	328		3175				1.89							
	AVG	356	1547	3164	494	1132	1.00	2.05	0.68	68	1.32	64	211	0.56	0.29
17/09	M	328	2400	3750	560	900	1.43	2.24	1.10	77	1.70	76			
	Tu	414	2325	3700	550	980	1.75	2.79	1.34	76	2.05	74			
	W	485	2625	4650	800	1520	2.31	4.10	1.61	70	2.76	67			
	Th	516	1850	3350	680	1280	1.74	3.14	1.10	63	1.94	62			
	F	490	2175	3350	660	1340	1.94	2.99	1.35	70	1.79	60			
	Sa	489		3900				3.47							
	Su	494						0.00							
	AVG	459	2275	3783	650	1204	1.90	3.16	1.36	71	2.15	68	261	0.35	0.22

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
24/09	M	461	3300	5450	1020	2200	2.77	4.57	1.91	69	2.72	60			
	Tu	475	4600	7500	1560	3100	3.97	6.48	2.63	66	3.80	59			
	W		3550	5150	1200	2200				66		57			
	Th		3175	4900	1080	2075				66		58			
	F	557	3125	4650	750	1150	3.16	4.71	2.40	76	3.54	75			
	Sa	354		4050				2.61			2.61				
	Su	262													
	AVG	422	3550	5283	1122	2145	2.72	4.05	1.86	68	2.41	59	496	0.48	0.37

Total lime use in 7 months of operation was 2300 minutes, or 11 minutes per day average. Almost all lime consumption can be traced to whey and milk spills which temporarily increased COD and acid concentration in the equalizing basin.

01/10	M	514	1375	2450	560	880	1.28	2.29	0.76	59	1.47	64			
	Tu	489	2800	4700	1010	2050	2.49	4.18	1.59	64	2.35	56			
	W	483	2550	4000	1020	1700	2.24	3.51	1.34	60	2.02	58			
	Th	479	1950	3000	640	925	1.70	2.61	1.14	67	1.81	69			
	F	414	2100	3600	920	1620	1.58	2.71	0.89	56	1.49	55			
	Sa	671		4200				5.13							
	Su	724		8400				11.05							
	AVG	539	2155	4336	830	1435	2.11	4.25	1.30	61	2.84	67	412	0.58	0.26
08/10	M	972	4550	6350	2650	4300	8.04	11.23	3.36	42	3.62	32			
	Tu	1105	2500	4000	1305	2750	5.02	8.04	2.40	48	2.51	31			
	W	953	2375	3950	1240	2475	4.11	6.84	1.97	48	2.55	37			
	Th	949	2650	4400	1185	2825	4.57	7.59	2.53	55	2.72	36			
	F	935	2500	4000	1240	2675	4.25	6.80	2.14	50	2.25	33			
	Sa	615		3300				3.69							
	Su	561		2800				2.85							
	AVG	870	2915	4114	1524	3005	4.61	6.51	2.20	48	1.75	27	588	0.49	0.61

REACTOR: FIXED FILM PERFORMANCE DATA Page 27 MONTH:OCT/NOV 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL.)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
15/10	M	962	1775	3550	850	2100	3.10	6.21	1.62	52	2.54	41			
	Tu	956	2000	3700	1120	2650	3.48	6.43	1.53	44	1.82	28			
	W	963	1775	3850	1010	2500	3.11	6.74	1.34	43	2.36	35			
	Th	958	1825	3350	1070	2400	3.18	5.84	1.32	41	1.66	28			
	F	854	2150	3700	1270	2525	3.34	5.74	1.37	41	1.82	32			
	Sa	517		4150				3.90							
	Su	574		4200				4.38							
	AVG	826	1905	3786	1064	2435	2.86	5.69	1.26	44	2.03	36	425	0.61	0.38
22/10	M	959	1400	2300	960	1800	2.44	4.01	0.77	31	0.87	22			
	Tu	1043	1900	3800	1260	2900	3.60	7.20	1.21	34	1.71	24			
	W	810	2125	3850	1300	2675	3.13	5.67	1.21	39	1.73	31			
	Th	617	2900	4650	1480	2950	3.25	5.72	1.59	49	1.91	37			
	F	527	2650	4450	1360	2650	2.54	4.27	1.24	49	1.73	40			
	Sa	524		3800				3.62							
	Su	524													
	AVG	715	2195	3808	1272	2595	2.85	4.95	1.20	42	1.58	32	388	0.59	0.45
29/10	M	581	1538	2575	980	1525	1.63	2.72	0.59	36	1.11	41			
	Tu	138	1725	3150	950	1800	0.43	0.79	0.19	45	0.34	43			
	W	531	2050	4075	255	638	1.98	3.93	1.73	88	3.32	84			
	Th	394	1650	3250	850	2100	1.18	2.33	0.57	48	0.82	35			
	F	458	2400	4400	850	1740	2.00	3.66	1.29	65	2.21	60			
	Sa	298		3850				2.09							
	Su	235		3550				1.52							
	AVG	376	1873	3550	777	1561	1.28	2.43	0.75	59	1.36	56	288	0.70	0.38

REACTOR: FIXED FILM PERFORMANCE DATA Page 28 MONTH:NOV 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
05/11	M	472	2650	4500	760	1800	2.27	3.86	1.62	71	2.32	60			
	Tu	525	2000	3600	1120	2150	1.91	3.44	0.84	44	1.38	40			
	W	446	2200	3600	1270	2300	1.78	2.92	0.75	42	1.05	36			
	Th	439	2800	4450	1270	2300	2.24	3.55	1.22	55	1.72	48			
	F	359	2500	4200	1280	2325	1.63	2.74	0.80	49	1.22	45	183	0.42	0.27
	Sa	220		3600				1.44					156	ERR	0.20
	Su	8		2000				0.03					156	ERR	9.75
	AVG	353	2430	3707	1140	2175	1.56	2.38	0.83	53	0.98	41	165	0.36	0.31
12/11	M	145	1138	2025	250	2080	0.30	0.53	0.23	78	-0.01	-3	120	0.93	-15.03
	Tu	230	1650	3150	235	470	0.69	1.32	0.59	86	1.12	85	155	0.48	0.25
	W	512	1800	3450	535	1460	1.67	3.21	1.18	70	1.85	58	249	0.38	0.24
	Th	476	2200	4150	1260	2550	1.90	3.59	0.81	43	1.39	39	287	0.64	0.38
	F	477	2100	3850	1270	2850	1.82	3.34	0.72	40	0.87	26	240	0.61	0.50
	Sa	366		3950				2.63					222		
	Su	327		2900				1.72					177		
	AVG	362	1778	3354	710	1882	1.17	2.21	0.70	60	0.97	44	207	0.54	0.39
19/11	M	328	1675	2600	780	1450	1.00	1.55	0.53	53	0.68	44	166	0.57	0.44
	Tu	334	2200	3800	840	1500	1.33	2.30	0.82	62	1.39	61	228	0.50	0.30
	W	300	2175	4000	1020	2125	1.19	2.18	0.63	53	1.02	47	206	0.60	0.37
	Th	236	2025	3500	840	1850	0.87	1.50	0.51	59	0.71	47	176	0.63	0.45
	F	226	1825	3150	720	1525	0.75	1.30	0.45	61	0.67	52	170	0.68	0.46
	Sa	197		3950				1.42					197		
	Su	81		6600				0.97					157		
	AVG	243	1980	3943	840	1690	0.87	1.74	0.50	58	1.00	57	186	0.67	0.34

REACTOR: FIXED FILM PERFORMANCE DATA Page 29 MONTH:NOV 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
26/11	M	227	2650	4200	540	1325	1.09	1.73	0.87	80	1.19	68	204	0.43	0.31
	Tu	268	2150	3550	700	1775	1.05	1.73	0.71	67	0.86	50	175	0.45	0.37
	W	137	2550	4300	950	2100	0.64	1.07	0.40	63	0.55	51	138	0.63	0.46
	Th	108	2425	4050	700	1525	0.48	0.80	0.34	71	0.50	62	128	0.68	0.47
	F	154	2350	4200	550	1700	0.66	1.17	0.50	77	0.70	60	140	0.51	0.36
	Sa														
	Su														
	AVG	179	2425	4060	688	1685	0.79	1.32	0.56	72	0.77	58	157	0.51	0.37

REACTOR: FIXED FILM PERFORMANCE DATA Page 29 MONTH:NOV 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
26/11	M	227	2650	4200	540	1325	1.09	1.73	0.87	80	1.19	68	204	0.43	0.31
	Tu	268	2150	3550	700	1775	1.05	1.73	0.71	67	0.86	50	175	0.45	0.37
	W	137	2550	4300	950	2100	0.64	1.07	0.40	63	0.55	51	138	0.63	0.46
	Th	108	2425	4050	700	1525	0.48	0.80	0.34	71	0.50	62	128	0.68	0.47
	F	154	2350	4200	550	1700	0.66	1.17	0.50	77	0.70	60	140	0.51	0.36
	Sa														
	Su														
	AVG	179	2425	4060	688	1685	0.79	1.32	0.56	72	0.77	58	157	0.51	0.37

REACTOR: FIXED FILM OPERATING DATA Page 1 MONTH:APR/MAY 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(%VSS)	(%VSS)
18/04	M	50		1800		400	7.5	7.0	31	28									
	Tu	48		1800			7.5	7.1	31	28									
	W	94		1850		410	7.5	7.3	31	27	890	1800	86	910	650	980	31	330	73	54
	Th	100	2300	1950	1250	477	7.4	7.4	30	28	915	5970	506	5055	645	2920	228	2275	70	49
	F	113	2050	2100	1080	420	7.5	7.3	30	28	1010	1430	47	420	710	720	1	10	70	50
	Sa	77					8.9	7.3		28										
	Su	0					8.6	7.3		28										
	AVG	69	2175	1900	1165	427	7.8	7.2	31	28	938	3067	147	2128	668	1540	60	872	71	50
25/04	M	64	1800	2200	830	90	7.5	7.3	30	28	865	10800	636	9935	615	4680	260	4065	71	43
	Tu	66	1700	2100	770	80	7.3	7.4	30	27	940	1580	42	640	690	840	10	150	73	53
	W	264	1500	1900	900	350	7.3	7.5	30	28	980	1440	121	460	750	720	-8	-30	77	50
	Th	250	1500	1750	850	410	7.4	7.5	30	28	940	1200	65	260	740	610	-33	-130	79	51
	F	255	1350	1675	810	580	7.5	7.4	30	29	1000	1200	51	200	770	660	-28	-110	77	55
	Sa	250																		
	Su	250																		
	AVG	200	1570	1925	832	302	7.4	7.4	30	28	945	3244	459	2299	713	1502	158	789	75	46
02/05	M	30	1220	1650	520	380	7.5	7.2	30	31	970	950	-1	-20	720	500	-7	-220	74	53
	Tu	311	1100	1450	590	340	7.3	7.4	31	30	890	760	-40	-130	740	450	-90	-290	83	59
	W	299	1300	1400	490	390	7.4	7.3	32	30	960	880	-24	-80	810	490	-96	-320	84	56
	Th	339	1400	1450	540	410	7.4	7.4	32	31	820	1030	71	210	550	450	-34	-100	67	44
	F	273	1350	1450	700	430	7.5	7.1	32	31	1040	920	-33	-120	900	520	-104	-380	87	57
	Sa	343					7.5	7.1	32	31										
	Su	0																		
	AVG	228	1274	1480	568	390	7.4	7.3	32	31	936	908	-6	-28	744	482	-60	-262	79	53

REACTOR: FIXED FILM OPERATING DATA Page 2 MONTH:MAY 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
09/05	M	349	950	1450	390	240	7.4	7.1	30	30	1160	330	-290	-830	810	260	-192	-550	70	79
	Tu	343	1000	1300	450	250	7.2	7.0		28	1020	525	-170	-495	675	280	-135	-395	66	53
	W	245	1400	1350	670	370	7.3	7.0	35	30	1420	565	-209	-855	1170	360	-198	-810	82	64
	Th	312	1250	1450	600	430		6.9		31	1140	715	-133	-425	930	410	-162	-520	82	57
	F	318	1100	1400	610	550	7.7	6.8	35	33	1020	675	-110	-345	720	365	-113	-355	71	54
	Sa	290																		
	Su	290																		
	AVG	307	1140	1390	544	368	7.4	7.0	33	30	1152	562	-181	-590	861	335	-161	-526	75	60
16/05	M	290	800	1400	280	260	7.2	7.0	30	32	500	320	-52	-180	420	200	-64	-220	84	63
	Tu	304	1000	1250	590	260	6.5	7.0	30	31	745	325	-128	-420	630	210	-128	-420	85	65
	W	324	1650	1650	860	580	7.4	6.9	32	32	1150	635	-167	-515	905	363	-176	-542	79	57
	Th	342	1500	1700	710	640	8.8	6.9		32	1000	985	-5	-15	810	520	-99	-290	81	53
	F	332	1450	1700	610	570	7.3	6.9		32	880	990	37	110	615	465	-50	-150	70	47
	Sa	340					8.2	7.0		30										
	Su	7					11.4	7.0		29										
	AVG	277	1280	1540	610	462	8.1	7.0	31	31	855	651	-57	-204	676	352	-90	-324	79	54
23/05	M	0					10.6													
	Tu	12					6.8													
	W	152	1300	1750	690	240	8.7	7.0	30	25	1320	15900	2216	14580	940	5870	749	4930	71	37
	Th	66	2500	1850	1750	300	7.4	7.1		31	1470	315	-76	-1155	1310	230	-71	-1080	89	73
	F	360	2350	2350	1710	1050	6.7	7.0	33	33	1320	425	-322	-895	1140	355	-283	-785	86	84
	Sa	0					5.2	7.0	35	32										
	Su	0					5.6	7.1	34	30										
	AVG	84	2050	1983	1383	530	7.3	7.0	33	30	1370	5547	352	4177	1130	2152	86	1022	82	39

REACTOR: FIXED FILM OPERATING DATA Page 3 MONTH:MAY/JUNE 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
30/05	M	47																		
	Tu	105	1350	2250	750	500	7.2	7.1	33	31	880	325	-58	-555	725	185	-57	-540	82	57
	W	205	1400	1950	820	470	7.8	7.1	33	31	1090	355	-151	-735	880	240	-131	-640	81	68
	Th	297	1000	1750	430	460	7.2	7.0	31	31	683	428	-76	-255	595	275	-95	-320	87	64
	F	379					7.0	7.0	32	31										
	Sa	174						6.9		28										
	Su	170						7.0		24										
	AVG	197	1250	1983	667	477	7.3	7.0	32	29	884	369	-101	-515	733	233	-98	-500	83	63
06/06	M	157					6.7	6.8	27	29	505	290	-34	-215	428	170	-41	-258	85	59
	Tu	192					6.4	6.8	32	29										
	W	313	900	1200	470	290	6.6	6.7	31	30	672	536	-43	-136	600	352	-78	-248	89	66
	Th	385	1000	1200	580	510														
	F	515																		
	Sa	296																		
	Su	359																		
	AVG	317	950	1200	525	400	6.6	6.8	30	29	589	413	-56	-176	514	261	-80	-253	87	63
13/06	M	245	1350	1400	1090	490		6.9	31	31	1120	312	-198	-808	1060	200	-211	-860	95	64
	Tu	424	1000	1400	460	590		7.2	33	32	775	204	-242	-571	685	150	-227	-535	88	74
	W	373	1100	1900	550	460		7.3	34	32	700	174	-196	-526	600	136	-173	-464	86	78
	Th	394	1700	1300	1300	410		7.2	34	33	1130	182	-374	-948	990	150	-331	-840	88	82
	F	493	1550	1650	980	800		7.2	34	34	1170	274	-442	-896	910	266	-317	-644	78	97
	Sa	197					6.0	7.3	34	32										
	Su	265					7.0	7.4	30	32										
	AVG	342	1340	1530	876	550	6.5	7.2	33	32	979	229	-256	-750	849	180	-228	-669	87	79

REACTOR: FIXED FILM OPERATING DATA Page 4 MONTH:JUNE/JULY 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
20/06	M	159	950	1620	560	235	6.6	7.4	33	33	560	520	-6	-40	510	352	-25	-158	91	68
	Tu	424	1050	1450	760	460	6.9	6.6	32	33	660	604	-24	-56	690	444	-104	-246	105	74
	W	475	1150	1350	550	470	7.8	7.0	34	34	610	376	-111	-234	530	304	-107	-226	87	81
	Th	432	1250	1400	350	250	7.6	7.4		34	330	344	6	14	255	248	-3	-7	77	72
	F	183					8.8	7.4	34	34										
	Sa	193																		
	Su	193																		
	AVG	294	1100	1455	555	354	7.5	7.2	33	34	540	461	-23	-79	496	337	-47	-159	92	73
27/06	M	193	950	1700	500	340	6.2	7.4	30	32	570	180	-75	-390	500	144	-69	-356	88	80
	Tu	238	1200	1600	810	350	6.4	7.3	32	32	900	336	-134	-564	820	228	-141	-592	91	68
	W	461	1050	1400	720	575	6.4	7.2	32	32	720	148	-264	-572	700	128	-264	-572	97	86
	Th	394	1250	1450	880	660	6.8	7.0	34	32	790	272	-204	-518	730	244	-191	-486	92	90
	F	561					7.6	7.0	33	32										
	Sa	449					6.7	7.0		30										
	Su	473					7.0	7.1		29										
	AVG	396	1113	1538	728	481	6.7	7.1	32	31	745	234	-202	-511	688	186	-198	-502	92	79
04/07	M	469	1080	1030	470	480	7.2	7.2	31	31	1070	510	-263	-560	1060	470	-277	-590	99	92
	Tu	508	1240	869	530	480	7.2	7.2	32	32	990	610	-193	-380	930	540	-198	-390	94	89
	W	489	1160	1200	480	490	7.8	7.0	32	32	830	500	-161	-330	710	440	-132	-270	86	88
	Th	490	1540	963	610	470	7.0	7.0	34	33	850	425	-208	-425	820	400	-206	-420	96	94
	F	525	1680	1260	700	650	7.3	7.0	33	33	1080	610	-247	-470	1000	535	-244	-465	93	88
	Sa	513					6.0	7.0	33	33										
	Su	565					6.4	7.0	27	32										
	AVG	508	1340	1064	558	514	7.0	7.1	32	32	964	531	-220	-433	904	477	-217	-427	94	90

REACTOR: FIXED FILM OPERATING DATA Page 5 MONTH:JULY 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
11/07	M	499	600	1150	130	630	8.0	7.0	28	30	600	560	-20	-40	590	507	-41	-83	98	91
	Tu	0					12.0	7.2	32	30										
	W	43						7.3	33	29										
	Th	340	1000	1300	520	330	7.0	7.2	30	32	367	427	20	60	360	387	9	27	98	91
	F	339	1050	1350		580	7.0	7.2	34	33	636	450	-63	-186	580	377	-69	-203	91	84
	Sa	463					6.5	7.5	35	23										
	Su	0					7.6	7.5		22										
	AVG	241	883	1267	325	513	8.0	7.3	32	28	534	479	-13	-55	510	424	-21	-86	95	88
18/07	M	296	700	1600	450	320	8.2		31		728	544	-54	-184	624	396	-67	-228	86	73
	Tu	532	1250	1450	710	470	7.0	7.4		33	720	304	-221	-416	656	268	-206	-388	91	88
	W	563	1050	1450	590	630	8.4	7.4	32	33	764	372	-221	-392	620	304	-178	-316	81	82
	Th	615	1150	1450	680	630	7.0	7.2	34	33	832	384	-276	-448	720	296	-261	-424	87	77
	F	607								33										
	Sa	345																		
	Su	345																		
	AVG	472	1038	1488	608	513	7.7	7.3	32	33	761	401	-170	-360	655	316	-160	-339	86	79
25/07	M	449					7.9	7.5												
	Tu	277					6.4		33											
	W	0					6.2		34											
	Th	0					7.2		35											
	F	0					6.5		35											
	Sa	0								24										
	Su	0								20										
	AVG	104					6.8	7.5	34	22										

REACTOR: FIXED FILM OPERATING DATA Page 6 MONTH:AUGUST 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
01/08	M	0																	
	Tu	132	1200	1500	560	60	7.7	7.6	34	30	768	430	-45	-338	624	272	-46	-352	81	63
	W	118	1120	1500	640	70	7.4	7.6	34	32	742	7950	851	7208	656	3010	278	2354	88	38
	Th	167	1250	1450	780	90	6.9	7.6	35	32	758	770	2	12	660	374	-48	-286	87	49
	F	159	1230	1470	615	85	6.7	7.3	35	33	845	496	-55	-349	665	242	-67	-423	79	49
	Sa	82					6.3	7.3		30										
	Su	62					9.2	8.0		22										
	AVG	103	1200	1480	649	76	7.4	7.6	35	30	778	1608	85	829	651	650	0	-2	84	40
08/08	M	15	1250	1500	660	30	6.9	7.5	32	33	785	46	-11	-739	745	40	-11	-705	95	87
	Tu	37	1070	1500	645	25	6.8	7.0	32	33	635	396	-9	-239	580	232	-13	-348	91	59
	W	189	1020	1470	625	106	8.0	7.4	35	34	785	392	-74	-393	730	290	-83	-440	93	74
	Th	161	1120	1450	625	55	7.0	7.6	33	33	770	636	-22	-134	715	320	-64	-395	93	50
	F	173	1200	1450	720	85	6.4	7.1	33	33	865	396	-81	-469	765	220	-94	-545	88	56
	Sa	126																		
	Su	39																		
	AVG	106	1132	1474	655	60	7.0	7.3	33	33	768	373	-42	-395	707	220	-51	-487	92	59
15/08	M	86	1830	1570	1143	15	6.5	7.1	31	33	1210	242	-83	-968	1040	160	-76	-880	86	66
	Tu	134	950	1550	625	90	6.8	7.4	34	33	860	330	-71	-530	785	204	-78	-581	91	62
	W	105	1100	1480	595	50	7.6	7.3	34	33	725	176	-58	-549	715	120	-62	-595	99	68
	Th	184	1050	1420	510	80	7.2	7.4	33	33	725	174	-101	-551	635	128	-93	-507	88	74
	F	95	1670	1400	1178	40	6.0	6.9	35	33	1430	168	-120	-1262	1420	132	-122	-1288	99	79
	Sa	150																		
	Su	40																		
	AVG	113	1320	1484	810	55	6.8	7.2	33	33	990	218	-88	-772	919	149	-87	-770	93	68

REACTOR: FIXED FILM OPERATING DATA Page 7 MONTH:AUG/SEPT 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
22/08	M	0	670	1600	220	25	8.6	7.6	32	33	615	150	0	-465	390	92	0	-298	63	61
	Tu	90	700	1580	435	50	6.9	7.5	33	33	495	66	-39	-429	470	58	-37	-412	95	88
	W	153	1070	1450	465	80	6.7	7.4	34	33	700	154	-84	-546	635	150	-74	-485	91	97
	Th	282	1420	1370	677	217	6.7	7.4	34	33	900	270	-178	-630	785	234	-155	-551	87	87
	F	102	1300	1400	1380	165	5.6	7.2	35	33	1600	128	-150	-1472	1550	124	-145	-1426	97	97
	Sa	148					6.8	7.2		30										
	Su	138					8.8	7.2												
	AVG	130	1032	1480	635	107	7.2	7.4	34	33	862	154	-92	-708	766	132	-83	-634	89	86
29/08	M	31					6.4	7.6		33										
	Tu	220					6.8	7.5		33										
	W	96					7.0	7.5		33										
	Th	74		1300			7.8	7.5		33										
	F	238																		
	Sa	131					8.2	7.6	36	31										
	Su	140					8.2	7.6	33	34										
	AVG	133		1300			7.4	7.6	35	33										
05/09	M	84																		
	Tu	84					7.0	7.8	34	32										
	W	241					6.1	7.5	34	32										
	Th	264					6.7	7.4	32	32										
	F	229					6.7	7.4	35	33										
	Sa	185					6.3	7.5	32	32										
	Su	0					8.2	7.5	29	31										
	AVG	155					6.8	7.5	33	32										

REACTOR: FIXED FILM OPERATING DATA Page 8 MONTH:SEPT 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
12/09	M	132		1200		100	6.8	7.6	31	31									
	Tu	165						7.5		31									
	W	180						7.5		32									
	Th	117						7.4		31									
	F	117						7.2		31									
	Sa	201					7.0	7.6		31									
	Su	177						7.8											
	AVG	156		1200		100	6.9	7.5	31	31									
19/09	M	63						7.6		33									
	Tu	364						7.5		34									
	W	404						7.0		33									
	Th	434																	
	F	488						7.2		33									
	Sa	505					6.7	7.1	32	25									
	Su	441					7.0	7.4	30	28									
	AVG	386					6.9	7.3	31	31									
26/09	M	373					7.6	7.5	31	31									
	Tu	524					6.5	7.4	33	31									
	W	504		1150		290	6.7	7.2	34	32									
	Th	411					7.1	7.4	33	32									
	F	436					6.6	7.4	34	32									
	Sa	402					9.4	7.4	34	34									
	Su	475					10.1	6.9	29	34									
	AVG	446		1150		290	7.7	7.3	33	32									

REACTOR: FIXED FILM OPERATING DATA Page 9 MONTH:OCT 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)
03/10	M	435					6.6	7.7	30	31								
	Tu	415					6.0	7.2	32	31								
	W	161																
	Th	161		1350		120	5.7	7.3	32	30								
	F	324					6.0	7.3	34	31								
	Sa	134					5.2	7.4	34	30								
	Su	261					6.6	7.2	29	28								
	AVG	270		1350		120	6.0	7.4	32	30								
10/10	M	199					6.6	7.3	28	28								
	Tu	293					7.0	7.3	30	29								
	W	385					6.2	7.3	33	30								
	Th	436					6.3	7.3	33	31								
	F	253					6.4	7.3	33	31								
	Sa	437					6.6	6.6	33	28								
	Su	193					6.6	7.2	33	29								
	AVG	314					6.5	7.2	32	29								
17/10	M	399					7.0	7.4	30	30								
	Tu	444					6.0	7.2	34	31								
	W	401					6.5	7.2	34	32								
	Th	419					6.2	7.2	35	33								
	F	400					6.7	7.4	34	33								
	Sa	403					6.2	7.2	35	21								
	Su	442					7.0	7.5	28	33								
	AVG	415					6.5	7.3	33	30								

REACTOR: FIXED FILM OPERATING DATA Page 10 MONTH:OCT/NOV 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
24/10	M	341					6.8	7.4	29	30								
	Tu	418						7.3		30								
	W	418					6.3	7.2	33	32								
	Th	443					6.6	7.3	32	32								
	F	462					6.4	7.4	34	32								
	Sa	434					7.2	7.4	24	28								
	Su	14					10.0	7.2	32	32								
	AVG	361					7.2	7.3	31	31								
31/10	M	246					7.2	7.4	32	32								
	Tu	395					6.7	7.4	32	32								
	W	497					6.8	7.4	32	32								
	Th	513					7.0	7.4	31	32								
	F	551					6.0	7.2	32	31								
	Sa	449					6.2	7.1	31	29								
	Su	442																
	AVG	442					6.7	7.3	32	31								
7/11	M	442																
	Tu	442					6.8	7.4	34	30								
	W	390					6.9	7.4	33	33								
	Th	209					6.7	7.5	34	32								
	F	374					6.8	7.4	33	32								
	Sa	391					10.2	7.2	33	32								
	Su						9.4	7.2	31	30								
	AVG	375					7.8	7.4	33	32								

REACTOR: FIXED FILM OPERATING DATA Page 11 MONTH:NOV 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
14/11	M	582					6.6	7.4	31	31										
	Tu	456					6.5	7.3	33	31										
	W	522					6.7	7.4	34	32										
	Th	601					6.4	7.4	32	32										
	F	600					6.4	7.4	33	32										
	Sa	504					7.0	6.9	34	34										
	Su	225					8.0	6.9	28	34										
	AVG	499					6.8	7.2	32	32										
21/11	M	212					6.2	6.8	29	31										
	Tu	420					5.6	6.7	34	31										
	W	384					6.8	6.8	34	32										
	Th	565					6.6	6.8	34	33										
	F	584					6.7	6.8	33	32										
	Sa	549					6.8	6.9	35	32										
	Su	537					7.2	6.9	31	30										
	AVG	464					6.6	6.8	33	32										
28/11	M	650					5.7	6.6	33	31										
	Tu	805					6.8	6.8	33	32										
	W	615					6.0	6.9	34	32										
	Th	673					6.8	6.8	34	33										
	F	749					5.8	6.8	34	33										
	Sa	737					6.4	6.8	32	32										
	Su	796					6.9	6.8	30	28										
	AVG	718					6.3	6.8	33	32										

REACTOR: FIXED FILM OPERATING DATA Page 12 MONTH:DEC 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
05/12	M	862					6.6	6.9	32	30									
	Tu	851					6.5	6.9	33	32									
	W	793					6.4	6.9	33	32									
	Th	704					6.5	6.9	32	32									
	F	744					6.6	7.0	33	32									
	Sa	841					6.8	7.0	36	34									
	Su	433					6.3	7.0	28	33									
	AVG	747					6.5	6.9	32	32									
12/12	M	978					6.2	7.0	29	30									
	Tu	837					6.5	6.9	32	30									
	W	931					6.2	6.6	32	30									
	Th	680					6.0	6.8	33	32									
	F	631					6.2	7.0	34	32									
	Sa	746					6.5	7.0	33	32									
	Su	824					6.8	7.0	30	28									
	AVG	804					6.3	6.9	32	31									
19/12	M	685					4.7	6.7	39	28									
	Tu	686	2400	2700	1700	1690	6.0	6.8	32	31	1540	1910	254	370	1470	1530	41	60	95	80
	W	873	1300	1950	790	620	6.0	7.0	32	31	840	830	-9	-10	755	700	-48	-55	90	84
	Th	991	1100	1400	690	390	6.6	7.0	32	31	718	720	2	2	635	583	-52	-52	88	81
	F	971	1500	1500	870	430	6.0	7.0	34	32	1160	795	-354	-365	1060	695	-354	-365	91	87
	Sa	939					6.2	7.0	32	29										
	Su	780					7.1	6.9	25	31										
	AVG	846	1575	1888	1013	783	6.1	6.9	32	30	1065	1064	-1	-1	980	877	-87	-103	92	82

REACTOR: FIXED FILM OPERATING DATA Page 13 MONTH:DEC 83/JAN 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
26/12	M	918					6.7	7.0	26	27									
	Tu	772	900	1150	360	170	6.8	7.1	29	26	693	342	-271	-351	635	312	-249	-323	92	91
	W	963	1300	1300	730	350	6.8	7.0	32	30	925	690	-226	-235	833	580	-244	-253	90	84
	Th	1132	950	1150	480	240	7.2	7.0	32	31	758	408	-396	-350	670	350	-362	-320	88	86
	F	1187	1050	1150	400	200	6.6	7.0	33	32	653	413	-285	-240	563	360	-241	-203	86	87
	Sa	976					6.9	7.0	33	33										
	Su	1084					6.3	7.0	26											
	AVG	1005	1050	1188	493	240	6.8	7.0	30	30	757	463	-295	-294	675	401	-276	-275	89	86
02/01	M	688					6.3	7.4	24											
	Tu	974	1050	1150	390	220	6.2	7.0	31	29	888	738	-146	-150	815	648	-163	-167	92	88
	W	611	1100	1400	750	250	5.9	7.0	33	31	945	555	-238	-390	815	495	-196	-320	86	89
	Th	553	950	1350	720	210	5.8	6.9	34	32	825	378	-247	-447	725	333	-217	-392	88	88
	F	606	1250	1250	790	180	5.9	7.0	34	33	820	265	-336	-555	700	240	-279	-460	85	91
	Sa	847					7.0	7.0	29	32										
	Su	715					6.6	6.9	28	32										
	AVG	713	1088	1288	663	215	6.2	7.0	30	32	870	484	-275	-386	764	429	-239	-335	88	89
09/01	M	661	750	850	340	110	7.2	6.9	30	28	493	180	-207	-313	440	164	-182	-276	89	91
	Tu	23	1050	1000	530	50	6.3	6.8	32	28	778	77	-16	-701	665	70	-14	-595	85	91
	W	0	1050	1100	470	40	6.8	6.8	33	28	770	58	0	-712	620	51	0	-569	81	88
	Th	0	1030	1150	590	30	6.8	6.8	33	28	805	46	0	-759	700	44	0	-656	87	96
	F	0	1100	1200	600	20	6.5	6.8	34	27	815	41	0	-774	720	40	0	-680	88	98
	Sa	0					6.9		30											
	Su	0					7.0		24											
	AVG	98	996	1060	506	50	6.8	6.8	31	28	732	80	-64	-652	629	74	-54	-555	86	92

REACTOR: FIXED FILM OPERATING DATA Page 14 MONTH:JAN 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
16/01	M	0	750	1300	410	20	6.4	6.8	26	27	563	37	0	-526	510	36	0	-474	91	97
	Tu	168	950	1300	450	20	6.4	7.1	29	27	658	52	-102	-606	583	51	-89	-532	89	98
	W	107	1150	1250	620	50	6.2	6.8	29	26	820	117	-75	-703	760	112	-69	-648	93	96
	Th	273	1275	1300	680	30	6.9	7.0	30	27	890	77	-222	-813	740	75	-182	-665	83	97
	F	345	1050	1350	630	120	6.6	7.1	30	28	758	283	-164	-475	663	247	-144	-416	87	87
	Sa	345					6.6	7.1	29	30										
	Su	345					8.8	7.0	25	27										
	AVG	226	1035	1300	558	48	6.8	7.0	28	27	738	113	-141	-625	651	104	-124	-547	88	92
23/04	M	612	500	1050	140	50	6.8	7.0	24	26	578	206	-228	-372	528	187	-209	-341	91	91
	Tu	677	850	950	450	110	6.8	7.0	29	27	730	290	-298	-440	670	278	-265	-392	92	96
	W	719	1000	1000	550	130	7.0	7.0	30	29	850	385	-334	-465	800	363	-314	-437	94	94
	Th	687	1800	1450	1170	380	6.7	6.9	32	30	1050	625	-292	-425	960	575	-264	-385	91	92
	F	584	1650	1700	1490	310	6.0	7.0	33	32	1355	498	-500	-857	1230	450	-456	-780	91	90
	Sa	401					6.4	7.0	32	32										
	Su	385					7.7	7.0	26	30										
	AVG	581	1160	1230	760	196	6.8	7.0	29	29	913	401	-297	-512	838	371	-271	-467	92	92
30/01	M	830	1000	1400	530	100	6.9	7.0	31	29	635	152	-401	-483	578	139	-364	-439	91	91
	Tu	824	850	1100	390	130	7.2	7.0	29	29	573	222	-289	-351	510	203	-253	-307	89	91
	W	860	1250	1050	680	130	7.1	7.0	33	30	885	325	-482	-560	780	298	-415	-482	88	92
	Th	836	1500	1250	1010	270	7.0	7.0	35	32	965	455	-426	-510	875	403	-395	-472	91	89
	F	821					7.1	7.0	34	33	658	308	-287	-350	638	293	-283	-345	97	95
	Sa	781					6.8	7.0	32	30										
	Su	764					5.8	7.0	31	34										
	AVG	817	1150	1200	653	158	6.8	7.0	32	31	743	292	-368	-451	676	267	-334	-409	91	91

REACTOR: FIXED FILM OPERATING DATA Page 15 MONTH:FEB 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
06/02	M	797	1050	1150	800	230	6.5	7.0	33	32	830	353	-380	-477	780	343	-348	-437	94	97
	Tu	812	1150	1300	810	230	6.6	7.0	33	32	840	388	-367	-452	775	343	-351	-432	92	88
	W	668	1100	1250	810	240	6.4	7.0	33	32	840	393	-299	-447	785	355	-287	-430	93	90
	Th	663	1150	1250	850	250	6.4	7.0	33	32	960	478	-320	-482	880	398	-320	-482	92	83
	F	698	1050	1200	820	270	6.4	7.0	31	31	905	525	-265	-380	820	450	-258	-370	91	86
	Sa	808					6.4	7.3	33											
	Su	827					6.8	7.0	32	32										
	AVG	753	1100	1230	818	244	6.5	7.0	33	32	875	427	-337	-448	808	378	-324	-430	92	88
13/02	M	816	1000	1150	680	260	6.8	7.0	32	32	705	390	-257	-315	625	355	-220	-270	89	91
	Tu	780	1350	1300	810	310	7.2	7.1	33	32	765	450	-246	-315	670	395	-215	-275	88	88
	W	797	1300	1300	820	300	7.3	7.2	31	32	850	460	-311	-390	755	405	-279	-350	89	88
	Th	803	1250	1350	830	290	6.8	7.2	34	34	810	433	-303	-377	745	383	-291	-362	92	88
	F	807	1500	1550	1430	360	6.0	7.2	36	35	1300	513	-635	-787	1130	433	-562	-697	87	84
	Sa	718					5.8	7.2	35	32										
	Su	745					6.8	7.2	31	36										
	AVG	781	1280	1330	914	304	6.7	7.2	33	33	886	449	-341	-437	785	394	-305	-391	89	88
20/02	M	652	1400	1350	910	270	7.0	7.2	29	33	955	453	-327	-502	830	380	-293	-450	87	84
	Tu	727	1150	1350	690	150	7.0	7.3	31		790	420	-269	-370	635	355	-204	-280	80	85
	W	783					7.2	7.2	31	31	820	325	-388	-495	640	270	-290	-370	78	83
	Th	777	1000	1150	340	160	6.9	7.2	29	30	720	376	-267	-344	580	312	-208	-268	81	83
	F	815	1100	1150	520	260	7.0	7.0	30	29	628	538	-73	-90	520	433	-71	-87	83	80
	Sa	789					6.8	7.0	28	28										
	Su	556					6.4	6.9	24	28										
	AVG	728	1163	1250	615	210	6.9	7.1	29	30	783	422	-262	-360	641	350	-212	-291	82	83

REACTOR: FIXED FILM OPERATING DATA Page 16 MONTH:FEB/MAR 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
27/02	M	785	800	850	370	70	7.4	6.9	26	26	530	268	-206	-262	418	220	-155	-198	79	82
	Tu	795	750	800	400	160	6.8	6.9	26	26	623	265	-285	-358	478	223	-203	-255	77	84
	W	847	750	800	190	90	6.8	7.0	25	25	715	590	-106	-125	305	253	-44	-52	43	43
	Th	842	650	750	100	70	7.0	7.0	25	25	650	400	-211	-250	505	303	-170	-202	78	76
	F	793	500	650	180	90	6.8	6.9	26	26	478	355	-98	-123	390	280	-87	-110	82	79
	Sa	788					6.8		27											
	Su	819					6.6		27											
	AVG	810	690	770	248	96	6.9	6.9	26	26	599	376	-181	-224	419	256	-132	-163	70	68
05/03	M	840	450	550	200	90	7.0	7.0	26	26	378	273	-88	-105	318	215	-87	-103	84	79
	Tu	867	950	850	520	190	6.9	6.9	32	30	700	530	-147	-170	610	410	-173	-200	87	77
	W	844	1200	1100	760	240	6.6	7.0	34	32	845	370	-401	-475	743	305	-370	-438	88	82
	Th	827	1250	1300	820	260	6.8	7.0	34	33	780	393	-320	-387	665	340	-269	-325	85	87
	F	822	1280	1300	940	250	6.3	7.0	33	32	925	455	-386	-470	820	390	-353	-430	89	86
	Sa	823					6.5	7.0	34	35										
	Su	780					6.7	7.0	27	33										
	AVG	829	1026	1020	648	206	6.7	7.0	31	32	726	404	-266	-321	631	332	-248	-299	87	82
12/03	M	818	950	1150	650	210	6.5	6.8	29	29	755	400	-290	-355	703	363	-278	-340	93	91
	Tu	668	900	1000	570	160	6.6	6.8	32	31	705	340	-244	-365	630	315	-210	-315	89	93
	W	823	1000	1150	520	140	7.0	7.0	32	31	675	270	-333	-405	620	253	-302	-367	92	94
	Th	822	1700	1650	1830	460	5.8	6.8	33	32	1440	715	-596	-725	1270	620	-534	-650	88	87
	F	826	1350	1650	1070	280	6.3	7.1	33	33	905	485	-347	-420	785	415	-306	-370	87	86
	Sa	497					5.8	7.0	34	33										
	Su	800					6.3	7.1	31	31										
	AVG	751	1180	1320	928	250	6.3	6.9	32	31	896	442	-341	-454	802	393	-307	-408	89	89

REACTOR: FIXED FILM OPERATING DATA Page 17 MONTH:MAR/APR 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
19/03	M	804	2500	1750	2120	580	6.3	6.9	34	33	1925	1005	-740	-920	1650	840	-651	-810	86	84
	Tu	816	1500	1850	1140	370	6.6	7.2	34	33	905	650	-208	-255	805	580	-184	-225	89	89
	W	611	1150	1350	920	220	6.4	7.1	34	33	1035	445	-360	-590	925	400	-321	-525	89	90
	Th	782	1250	1350	1340	110	5.8	7.0	33	32	1200	715	-379	-485	1090	585	-395	-505	91	82
	F	786	1350	1450	940	260	6.4	7.1	34	33	1105	505	-472	-600	965	438	-414	-527	87	87
	Sa	695					6.9	7.0	38	31										
	Su	349					6.7	7.0	34	35										
	AVG	692	1550	1550	1292	308	6.4	7.0	34	33	1234	664	-394	-570	1087	569	-359	-518	88	86
26/03	M	742	1050	1450	460	150	7.0	7.0	30	33	965	278	-510	-687	830	250	-430	-580	86	90
	Tu	727	1050	1250	570	170	6.8	7.0	32	32	820	448	-270	-372	730	378	-256	-352	89	84
	W	762	1200	1200	690	200	6.8	6.8	34	33	865	405	-351	-460	760	340	-320	-420	88	84
	Th	751	1250	1300	700	300	7.0	6.9	34	33	735	325	-308	-410	665	293	-279	-372	90	90
	F	647	1350	1350	780	220	7.1	6.9	34	33	715	423	-189	-292	625	348	-179	-277	87	82
	Sa	434					7.1	6.9	38	36										
	Su						7.1	6.8	33	34										
	AVG	677	1180	1310	640	208	7.0	6.9	34	33	820	376	-301	-444	722	322	-271	-400	88	86
02/04	M	492	1100	1400	600	40	7.0	6.8	34	35	680	248	-213	-432	575	208	-181	-367	85	84
	Tu	685	1300	1250	1050	40	6.2	6.8	36	34	940	165	-531	-775	815	155	-452	-660	87	94
	W	708	1400	1400	1180	160	6.2	7.0	37	35	995	288	-501	-707	840	263	-409	-577	84	91
	Th	781	1200	1400	880	80	6.8	7.0	34	35	855	233	-486	-622	725	203	-408	-522	85	87
	F	728	1100	1250	600	110	7.2	7.0	34	35	765	248	-376	-517	640	213	-311	-427	84	86
	Sa	876					6.6	7.0	37	35										
	Su	842					6.6	7.0	31	33										
	AVG	730	1220	1340	862	86	6.7	6.9	35	35	847	236	-446	-611	719	208	-373	-511	85	88

REACTOR: FIXED FILM OPERATING DATA Page 18 MONTH:APR 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
09/04	M	842	1050	1300	760	190	6.6	7.0	28	29	690	295	-333	-395	600	260	-286	-340	87	88
	Tu	800	1200	1300	700	170	7.0	7.1	35	33	790	393	-318	-397	640	325	-252	-315	81	83
	W	825	1350	1350	1100	210	6.2	7.1	36	35	840	400	-363	-440	775	338	-361	-437	92	85
	Th	677	1500	1350	1040	180	6.8	7.0	37	37	865	415	-305	-450	745	350	-267	-395	86	84
	F	753	1200	1350	780	110	6.7	7.2	34	34	740	260	-361	-480	660	235	-320	-425	89	90
	Sa	755					6.9	7.1	35	35										
	Su	775					6.8	7.1	31	33										
	AVG	775	1260	1330	876	172	6.7	7.1	34	34	785	353	-335	-432	684	302	-296	-382	87	86
16/04	M	812	1000	1200	790	200	6.4	7.0	30	31	670	325	-280	-345	580	275	-248	-305	87	85
	Tu	916	1450	1500	900	260	6.8	7.1	32	31	875	510	-334	-365	775	445	-302	-330	89	87
	W	872	1550	1550	1050	260	7.0	7.2	34	34	945	533	-359	-412	795	450	-301	-345	84	84
	Th	852	1550	1600	1040	210	6.8	7.2	34	34	925	435	-417	-490	800	378	-360	-422	86	87
	F	826	1750	1550	1090	200	7.5	7.3	36	35	995	410	-483	-585	835	365	-388	-470	84	89
	Sa	793					6.7	7.1	30	31										
	Su	657					6.8	7.2	27	30										
	AVG	818	1460	1480	974	226	6.9	7.2	32	32	882	443	-360	-439	757	383	-306	-374	86	86
23/04	M	828	850	1050	420	120	6.8	7.0	30	29	735	408	-271	-327	650	335	-261	-315	88	82
	Tu	787	1250	1350	740	190	7.0	7.2	33	31	760	440	-252	-320	695	380	-248	-315	91	86
	W	704	1050	1200	600	130	7.0	7.2	35	33	635	280	-250	-355	590	255	-236	-335	93	91
	Th	772	1400	1250	710	80	7.8	7.0	37	34	825	233	-457	-592	700	213	-376	-487	85	91
	F	814	1050	1300	1010	190	6.0	7.0	38	37	1010	525	-395	-485	895	463	-352	-432	89	88
	Sa	884					6.1	7.1	39	38										
	Su	907					6.6	7.1	33	35										
	AVG	814	1120	1230	696	142	6.8	7.1	35	34	793	377	-338	-416	706	329	-307	-377	89	87

REACTOR: FIXED FILM OPERATING DATA Page 19 MONTH:APR/MAY 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
30/04	M	957	1000	1150	940	210	6.0	7.0	32	32	1600	445	-1105	-1155	1515	415	-1053	-1100	95	93
	Tu	796	1300	1350	840	200	6.8	7.1	37	35	790	390	-318	-400	745	363	-304	-382	94	93
	W	735	1300	1600	810	210	6.7	7.2	36	35	745	365	-279	-380	660	338	-237	-322	89	93
	Th	745	1050	1250	790	150	6.4	7.1	34	35	870	300	-425	-570	815	278	-400	-537	94	93
	F	774	1200	1300	760	140	6.6	7.2	37	36	820	303	-400	-517	750	275	-368	-475	91	91
	Sa	753					6.5	7.2	38	37										
	Su	731					7.0	7.2	32	34										
	AVG	784	1170	1330	828	182	6.6	7.1	35	35	965	361	-474	-604	897	334	-442	-563	93	93
07/05	M	749	1350	1150	1300	250	6.4	6.8	30	31	890	358	-398	-532	805	343	-346	-462	90	96
	Tu	751	1150	1250	780	150	6.8	7.0	37	34	775	280	-372	-495	685	253	-309	-412	86	90
	W	815	1100	1300	620	150	6.9	7.0	33	34	648	240	-333	-408	598	228	-302	-370	92	95
	Th	802	1100	1250	720	190	6.6	7.0	33	33	640	298	-274	-342	595	278	-254	-317	93	93
	F	786	950	1150	600	130	6.8	7.0	36	35	545	210	-263	-335	505	198	-241	-307	93	94
	Sa	499					6.2	6.6	39	38										
	Su	687					10.8	7.2	33	35										
	AVG	727	1130	1220	804	174	7.2	6.9	34	34	700	277	-307	-422	634	260	-272	-374	91	94
14/03	M	425	1150	1650	560	130	7.0	7.4	32	34	605	275	-140	-330	515	248	-113	-267	85	90
	Tu	766	1200	1550	430	70	7.4	7.2	36	34	715	214	-384	-501	588	197	-300	-391	82	92
	W	785	1300	1450	780	200	7.2	7.2	37	37	830	370	-361	-460	725	328	-312	-397	87	89
	Th	788	1200	1350	620	180	7.0	7.1	34	35	685	313	-293	-372	625	288	-266	-337	91	92
	F	749	1300	1350	800	150	6.9	7.0	38	36	715	285	-322	-430	665	253	-309	-412	93	89
	Sa	706					6.5	7.0	41	39										
	Su	678					6.6	7.0	33	36										
	AVG	700	1230	1470	638	146	6.9	7.1	36	36	710	291	-293	-419	624	263	-252	-361	88	90

REACTOR: FIXED FILM OPERATING DATA Page 20 MONTH:MAY/JUNE 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
21/05	M	730	750	1000	410	130	6.9	7.0	31	33	363	173	-139	-190	318	168	-110	-150	88	97
	Tu	673	1050	1000	660	170	6.7	6.8	31	31	605	300	-205	-305	560	280	-188	-280	93	93
	W	763	1400	1350	640	140	7.0	7.1	38	34	865	356	-388	-509	800	328	-360	-472	92	92
	Th	775	900	1200	490	140	6.8	7.0	37	37	555	270	-221	-285	480	235	-190	-245	86	87
	F	681	1050	1100	640	150	6.7	7.0	37	38	645	283	-247	-362	555	265	-197	-290	86	94
	Sa	749					6.4	7.0	41	39										
	Su	627					6.8	7.0	34	36										
	AVG	714	1030	1130	568	146	6.8	7.0	36	35	607	276	-236	-330	543	255	-205	-287	89	92
28/05	M	948	650	800	360	130	6.8	6.8	31	34	540	230	-294	-310	510	215	-280	-295	94	93
	Tu	925	700	900	400	130	6.8	6.8	34	35	490	222	-248	-268	450	206	-226	-244	92	93
	W	970	1050	1150	700	150	7.0	6.8	36	36	584	254	-320	-330	538	238	-291	-300	92	94
	Th	694	900	1150	650	120	6.8	6.9	36	37	600	210	-271	-390	542	188	-246	-354	90	90
	F	889	3700	1600	2920	300	6.8	7.0	36	38	2115	784	-1183	-1331	1925	672	-1114	-1253	91	86
	Sa	870					6.4	7.3	37	38										
	Su	854					6.6	7.2	32	34										
	AVG	878	1400	1120	1006	166	6.7	7.0	35	36	866	340	-462	-526	793	304	-430	-489	92	89
04/06	M	890	1200	1400	900	190	6.6	7.0	30	31	815	303	-456	-512	760	280	-427	-480	93	92
	Tu	883	1250	1350	710	170	7.0	7.0	35	35	625	293	-293	-332	570	268	-267	-302	91	91
	W	895	1950	1450	1400	280	6.7	7.0	38	38	1030	503	-472	-527	910	453	-409	-457	88	90
	Th	875	1200	1350	750	170	6.9	7.0	35	37	663	338	-284	-325	563	285	-243	-278	85	84
	F	858	1200	1250	760	140	7.0	7.0	38	38	685	305	-326	-380	613	278	-287	-335	89	91
	Sa	832					7.0	7.0	40	39										
	Su	690					7.0	7.0	34	37										
	AVG	846	1360	1360	904	190	6.9	7.0	36	36	764	348	-351	-415	683	313	-313	-370	89	90

REACTOR: FIXED FILM OPERATING DATA Page 21 MONTH:JUNE 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
11/06	M	573	900	1050	170	90	7.4	7.0	32	33	660	340	-183	-320	610	315	-169	-295	92	93
	Tu	799	900	1150	360	90	7.0	6.9	39	35	665	315	-280	-350	645	290	-284	-355	97	92
	W	831	850	1050	410	100	7.0	6.7	39	38	552	192	-299	-360	494	184	-258	-310	89	96
	Th	782	900	1050	560	110	6.6	7.2	38	39	647	240	-318	-407	610	238	-291	-372	94	99
	F	814	1000	1200	580	130	6.8	6.8	36	37	670	232	-357	-438	595	214	-310	-381	89	92
	Sa	784					6.4	6.6	39	38										
	Su	787					6.4	6.7	35	37										
	AVG	767	910	1100	416	104	6.8	6.8	37	37	639	264	-288	-375	591	248	-283	-343	92	94
18/06	M	808	850	1100	530	110	6.9	6.7	34	33	527	213	-254	-314	474	203	-219	-271	90	95
	Tu	807	1200	1200	670	130	6.8	7.0	36	35	715	263	-365	-452	623	241	-308	-382	87	92
	W	787	1250	1300	670	140	6.8	7.1	34	34	585	243	-269	-342	515	228	-226	-287	88	94
	Th	752	1550	1450	1060	180	6.2	7.0	36	38	825	345	-361	-480	725	315	-308	-410	88	91
	F	712	1700	1550	1050	180	6.6	7.2	36	37	770	313	-325	-457	700	298	-286	-402	91	95
	Sa	728					6.8	7.2	40	38										
	Su	714					6.8	7.2	33	37										
	AVG	758	1310	1320	796	148	6.7	7.1	36	36	684	275	-310	-409	607	257	-266	-350	89	93
25/06	M	733	1400	1300	900	160	6.6	7.1	35	35	838	330	-372	-508	780	298	-353	-482	93	90
	Tu	789	1200	1200	830	100	6.0	7.0	39	37	868	255	-484	-613	763	233	-418	-530	88	91
	W	756	1250	1300	690	90	6.8	7.0	40	39	655	222	-327	-433	575	202	-282	-373	88	91
	Th	524	1200	1300	640	80	6.8	7.0	40	39	960	229	-383	-731	873	219	-343	-654	91	96
	F	765	1250	1350	750	50	6.6	7.0	34	37	903	153	-574	-750	780	133	-495	-647	86	87
	Sa	735					6.7	7.0	40	38										
	Su	684					6.8	7.1	35	37										
	AVG	712	1260	1290	762	96	6.6	7.0	38	37	845	238	-432	-607	754	217	-383	-537	89	91

REACTOR: FIXED FILM OPERATING DATA Page 22 MONTH: JULY 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)
02/07	M	704					6.6	7.1	34	37								
	Tu	660					6.8	7.0	37	35								
	W	728					6.9	7.1		38								
	Th	692					6.8	7.2	38	38								
	F	1077					6.3	7.0	37	38								
	Sa	564					6.0	7.0	33	38								
	Su	758					6.4	7.0	32	35								
	AVG	740					6.5	7.1	35	37								
09/07	M	1351					6.7	7.0	32	34								
	Tu	1343					6.0	7.0	36	37								
	W	1347					6.6	7.0	35	38								
	Th	1273					6.8	7.0	36	37								
	F	1226					6.4	7.0	37	37								
	Sa	537					6.7	7.0	34	38								
	Su	794					6.6	6.9	32	37								
	AVG	1124					6.5	7.0	35	37								
16/07	M	1263	1150	1150	750	280	6.4	6.6	33	34	578	350	-288	-228	515	303	-268	-212	89	87
	Tu	1273	1300	1300	740	230	6.6	6.7	38	36	790	513	-353	-277	690	385	-388	-305	87	75
	W	1161	1250	1300	710	280	6.6	6.9	38	38	673	510	-189	-163	590	420	-197	-170	88	82
	Th	1244	1300	1300	780	350	6.7	7.0	33	37	705	385	-398	-320	620	350	-336	-270	88	91
	F	1157	1100	1200	660	250	6.6	7.0	37	38	628	314	-363	-314	538	260	-322	-278	86	83
	Sa	740		2500		1050	6.2	7.0	41	40								
	Su	828	2050	2150	1660	510	6.4	7.2	34	38								
	AVG	1095	1358	1557	883	421	6.5	6.9	36	37	675	414	-285	-260	591	344	-270	-247	88	83

REACTOR: FIXED FILM OPERATING DATA Page 23 MONTH: JULY/AUGUST 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)		(mg/L)	(mg/L)	(Kg/d)		(%VSS)	(%VSS)
23/07	M	1156	1300	1600	880	420	6.8	7.1	31	35	714	505	-242	-209	649	455	-224	-194	91	90
	Tu	1298	1500	1450	930	320	6.6	7.0	37	36	761	424	-437	-337	668	367	-391	-301	88	87
	W	1468	1250	1300	760	340	6.8	7.0	38	37	728	505	-327	-223	623	410	-313	-213	86	81
	Th	1291	1550	1500	1350	630	6.0	6.8	38	38	1380	1020	-465	-360	1305	965	-439	-340	95	95
	F	1204	1450	1350	830	340	6.8	7.0	35	38	817	473	-414	-344	713	413	-361	-300	87	87
	Sa	693					6.3	7.0	38	37										
	Su	824					6.2	7.0	36	37										
	AVG	1133	1410	1440	950	410	6.5	7.0	36	37	880	585	-334	-295	792	522	-306	-270	90	89
30/07	M	1269	1300	1450	770	390	6.8	7.0	33	34	621	465	-198	-156	585	418	-212	-167	94	90
	Tu	1060	1350	1350	800	290	6.8	7.0	37	37	645	288	-378	-357	558	268	-307	-290	87	93
	W	1247	1500	1400	920	330	6.8	7.0	35	36	638	453	-231	-185	533	355	-222	-178	84	78
	Th	1214	1450	1350	900	410	6.8	7.0	36	36	633	390	-295	-243	523	332	-232	-191	83	85
	F	1266	1450	1500	910	360	6.8	7.0	37	37	618	302	-400	-316	545	282	-333	-263	88	93
	Sa	589					6.8	7.0	39	38										
	Su	1255					6.6	7.1	36	37										
	AVG	1128	1410	1410	860	356	6.8	7.0	36	36	631	380	-284	-251	549	331	-246	-218	87	87
06/08	M	1154	1600	1650	1040	400	6.5	7.1	35	35	794	573	-255	-221	706	490	-249	-216	89	86
	Tu	1162	1350	1450	790	300	6.8	7.2	36	37	588	265	-375	-323	485	232	-294	-253	82	88
	W	1037	1300	1250	860	400	6.6	7.0	35	35	822	467	-368	-355	697	414	-294	-283	85	89
	Th	1063	1400	1500	820	380	6.6	7.0	36	36	791	370	-448	-421	663	315	-370	-348	84	85
	F	1254					6.6	7.1	38	37										
	Sa	613					6.2	7.0	39	37										
	Su	764					6.2	7.1	35	36										
	AVG	1007	1413	1463	878	370	6.5	7.1	36	36	749	419	-332	-330	638	363	-277	-275	85	87

REACTOR: FIXED FILM OPERATING DATA Page 24 MONTH:AUGUST/SEPT 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
13/08	M	1274	1200	1400	810	470	6.3	7.0	34	35	592	372	-280	-220	524	325	-253	-199	89	87
	Tu	1213	1300	1350	790	390	6.8	7.0	36	37	671	418	-307	-253	592	365	-275	-227	88	87
	W	1096	1350	1300	980	520	6.2	6.9	36	37	762	475	-315	-287	685	433	-276	-252	90	91
	Th	1100	1700	1500	1230	470	6.5	7.0	37	37	944	950	7	6	791	730	-67	-61	84	77
	F	1344	1550	1600	960	410	6.8	7.1	37	37	790	513	-372	-277	670	428	-325	-242	85	83
	Sa	615					6.7	7.2	38	38										
	Su	843					5.8	7.0	35	37										
	AVG	1069	1420	1430	954	452	6.4	7.0	36	37	752	546	-220	-206	652	456	-210	-196	87	84
20/08	M	1466	1400	1450	890	430	6.6	7.0	35	35	924	565	-526	-359	894	518	-551	-376	97	92
	Tu	1097	1650	1700	1110	550	6.7	7.0	36	36	884	650	-257	-234	780	565	-236	-215	88	87
	W	1176	1550	1550	960	420	6.7	7.0	36	35	913	600	-368	-313	757	515	-285	-242	83	86
	Th	1213	1350	1400	830	420	6.8	7.0	36	36	728	615	-137	-113	613	468	-176	-145	84	76
	F	1206	1350	1300	760	400	6.8	7.0	35	35	850	456	-475	-394	718	380	-408	-338	84	83
	Sa	1059					6.7	7.0	36	36										
	Su	1145					6.8	7.2	36	36										
	AVG	1195	1460	1480	910	444	6.7	7.0	36	36	860	577	-338	-283	752	489	-314	-263	88	85
27/08	M	1182	1000	1200	660	450	6.7	7.0	32	33	545	342	-240	-203	490	293	-233	-197	90	86
	Tu	1112	1350	1400	880	470	6.8	7.0	35	35	830	518	-347	-312	720	440	-311	-280	87	85
	W	1197	1200	1250	860	450	6.4	7.0	36	36	710	478	-278	-232	620	413	-248	-207	87	86
	Th	1285	1600	1550	1280	420	6.0	6.9	36	35	1100	638	-593	-462	950	508	-568	-442	86	80
	F	1202	1350	1450	1100	560	6.0	6.8	36	35	850	545	-367	-305	750	485	-319	-265	88	89
	Sa	683					6.0	7.0	38	37										
	Su	742					6.0	7.0	34	35										
	AVG	1058	1300	1370	956	470	6.3	7.0	35	35	807	504	-320	-303	706	428	-294	-278	87	85

REACTOR: FIXED FILM OPERATING DATA Page 25 MONTH:SEPT 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
03/09	M	1210					6.0	6.9	34	35										
	Tu	1102	1350	1250	930	490	6.3	6.7	36	35	614	472	-156	-142	544	417	-140	-127	89	88
	W	957	1650	1550	990	530	6.9	7.0	36	35	1030	545	-464	-485	923	488	-416	-435	90	90
	Th	1009	1500	1450	920	490	6.5	6.9	36	35	860	500	-363	-360	747	443	-307	-304	87	89
	F	941	1600	1700	940	440	6.5	7.0	37	36	1039	798	-227	-241	947	655	-275	-292	91	82
	Sa	327					7.0	7.0	39	38										
	Su	175					6.5	7.1	36	38										
	AVG	817	1525	1488	945	488	6.5	6.9	36	36	886	579	-251	-307	790	501	-237	-290	89	87
10/09	M	277	1400	1950	740	150	6.6	7.0	34	36	720	378	-95	-342	647	284	-101	-363	90	75
	Tu	281	1700	1700	740	150	6.9	7.0	36	35	1104	235	-244	-869	957	184	-217	-773	87	78
	W	391	1850	2000	700	210	7.0	7.0	37	36	1135	590	-213	-545	1025	543	-189	-482	90	92
	Th	409	1650	1800	740	250	6.8	7.0	37	37	1045	548	-203	-497	920	473	-183	-447	88	86
	F	410	1300	1450	990	270	6.1	7.0	37	37	793	305	-200	-488	707	274	-178	-433	89	90
	Sa	396					6.0	7.0	38	37										
	Su	328					6.0	6.9	35	37										
	AVG	356	1580	1780	782	206	6.5	7.0	36	36	959	411	-195	-548	851	352	-178	-500	89	86
17/09	M	328	1200	1350	1200	220	5.8	6.8	34	35	900	171	-239	-729	837	156	-223	-681	93	91
	Tu	414	1300	1350	1070	230	6.0	6.8	36	35	745	171	-238	-574	673	154	-215	-519	90	90
	W	485	1450	1500	1160	330	6.0	6.8	37	36	1080	378	-340	-702	1004	327	-328	-677	93	87
	Th	516	1200	1250	890	290	6.0	6.8	37	37	807	305	-259	-502	700	265	-225	-435	87	87
	F	490	1250	1250	880	280	6.0	6.8	38	37	685	327	-175	-358	615	298	-155	-317	90	91
	Sa	489					6.1	6.8	38	37										
	Su	494					6.0	6.8	27	34										
	AVG	459	1280	1340	1040	270	6.0	6.8	35	36	843	270	-263	-573	766	240	-242	-526	91	89

REACTOR: FIXED FILM OPERATING DATA Page 26 MONTH:SEPT/OCT 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
24/09	M	461	1450	1200	1400	510	5.7	6.4	26	28	1425	715	-327	-710	1370	663	-326	-707	96	93
	Tu	475	2200	2000	2070	700	5.6	6.7	33	30	1715	1100	-292	-615	1555	960	-283	-595	91	87
	W		1750	2050	1360	480	6.0	7.0	35	33	1125	793		-332	1035	659		-376	92	83
	Th		1550	1750	1270	450	6.0	6.9	35	34	920	495		-425	830	448		-382	90	91
	F	557	1550	1650	1260	270	6.1	6.9	35	34	865	232	-352	-633	765	205	-312	-560	88	88
	Sa	354					6.0	6.9	35	35										
	Su	262					6.1	7.0	33	34										
	AVG	422	1700	1730	1472	482	5.9	6.8	33	33	1210	667	-229	-543	1111	587	-221	-524	92	88
01/10	M	514	850	1250	640	180	5.9	6.9	31	33	600	183	-214	-417	557	178	-195	-379	93	97
	Tu	489	1450	1400	1140	470	6.0	6.7	34	33	1050	663	-189	-387	935	568	-179	-367	89	86
	W	483	1350	1500	1180	400	6.1	6.8	34	33	905	423	-233	-482	850	385	-224	-465	94	91
	Th	479	1150	1400	890	230	6.2	6.9	35	34	703	262	-211	-441	613	192	-201	-421	87	73
	F	414	1500	1500	1010	380	6.4	6.9	35	34	903	425	-198	-478	820	367	-187	-453	91	86
	Sa	671					6.0	6.9	35	35										
	Su	724					5.8	6.8	34	34										
	AVG	539	1260	1410	972	332	6.1	6.8	34	34	832	391	-238	-441	755	338	-225	-417	91	86
08/10	M	972	1880	1280	1880	930	5.8	6.9	33	34	1326	1135	-186	-191	1196	1015	-176	-181	90	89
	Tu	1105					6.0	6.8	33	33	920	725	-215	-195	830	640	-210	-190	90	88
	W	953	1300	1350	1030	490	6.0	6.8	34	34	875	767	-103	-108	790	680	-105	-110	90	89
	Th	949	1400	1350	1140	520	6.0	6.8	34	35	1070	800	-256	-270	955	685	-256	-270	89	86
	F	935	1300	1450	1050	530	6.0	6.8	34	34	975	915	-56	-60	875	790	-79	-85	90	86
	Sa	615		1150			6.0	6.8	36	36										
	Su	561					6.0	6.8	31	34										
	AVG	870	1470	1316	1275	618	6.0	6.8	34	34	1033	868	-143	-165	929	762	-145	-167	90	88

REACTOR: FIXED FILM OPERATING DATA Page 27 MONTH:OCT/NOV 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
15/10	M	962	900	950	760	350	6.0	6.8	32	32	1055	720	-322	-335	970	650	-308	-320	92	90
	Tu	956	1050	1100	820	470	6.0	6.7	33	33	1080	925	-148	-155	1020	865	-148	-155	94	94
	W	963	1000	1050	740	430	6.0	6.7	34	34	1140	850	-279	-290	1070	795	-265	-275	94	94
	Th	958	1060	1050	790	440	6.0	6.8	34	34	930	830	-96	-100	845	720	-120	-125	91	87
	F	854	1000	1150	850	480	6.0	6.7	34	34	870	680	-162	-190	815	650	-141	-165	94	96
	Sa	517	1300	1250	1150	390	6.0	6.8	34	34										
	Su	574					6.0	6.8	30	34										
	AVG	826	1052	1092	852	427	6.0	6.8	33	34	1015	801	-177	-214	944	736	-172	-208	93	92
22/10	M	959	750	900	600	380	6.0	6.8	29	30	680	590	-86	-90	640	537	-99	-103	94	91
	Tu	1043	1050	1050	840	520	6.1	6.6	32	32	1140	1025	-120	-115	1080	955	-130	-125	95	93
	W	810	1100	1150	870	390	6.0	6.6	33	33	1005	830	-142	-175	970	785	-150	-185	97	95
	Th	617	1450	1450	1290	580	6.1	6.8	33	33	1145	870	-170	-275	1050	790	-160	-260	92	91
	F	527	1650	1700	1100	540	6.6	7.0	34	34	1170	870	-158	-300	1085	790	-156	-295	93	91
	Sa	524					6.2	7.0	34	34										
	Su	524					6.2	6.8	31	32										
	AVG	715	1200	1250	940	482	6.2	6.8	32	33	1028	837	-136	-191	965	771	-138	-194	94	92
29/10	M	581	900	1050	630	320	6.2	6.8	31	31	690	420	-157	-270	610	368	-141	-242	88	88
	Tu	138	950	1010	640	340	6.2	6.8	34	32	935	600	-46	-335	840	533	-42	-307	90	89
	W	531	1150	1250	790	60	6.3	6.8	34	31	1110	330	-414	-780	1035	295	-393	-740	93	89
	Th	394	1050	1100	690	320	6.3	7.0	35	34	965	1044	31	79	850	756	-37	-94	88	72
	F	458	1450	1250	1030	300	6.3	6.9	35	34	1218	800	-191	-418	1075	595	-220	-480	88	74
	Sa	298					6.3	6.8	34	34										
	Su	235					6.2	6.8	31	36										
	AVG	376	1100	1132	756	268	6.3	6.8	33	33	984	639	-130	-345	882	509	-140	-373	90	80

REACTOR: FIXED FILM OPERATING DATA Page 28 MONTH:NOV 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
05/11	M	472	1150	1250	910	290	6.1	6.8	30	31	1260	1173	-41	-87	1185	907	-131	-278	94	77
	Tu	525	1150	1150	830	370	6.3	6.7	32	32	975	720	-134	-255	865	610	-134	-255	89	85
	W	446	1200	1300	980	440	6.3	6.8	33	33	870	670	-89	-200	750	565	-82	-185	86	84
	Th	439	1450	1350	1160	470	6.2	6.8	34	33	1095	765	-145	-330	960	640	-141	-320	88	84
	F	359	1500	1500	1150	530	6.3	6.8	34	33	1092	780	-112	-312	1003	675	-118	-328	92	87
	Sa	220					6.3	7.0	35	34										
	Su	8					6.3	7.0	34	33										
	AVG	353	1290	1310	1006	420	6.3	6.8	33	33	1058	822	-84	-237	953	679	-96	-273	90	83
12/11	M	145	850	1550	570	60	6.2	7.0	31	32	620	1340	105	720	555	865	45	310	90	65
	Tu	230	950	1300	740	80	6.3	7.0	32	31	900	202	-161	-698	820	180	-147	-640	91	89
	W	512	950	1250	840	190	6.0	6.9	34	32	1005	1050	23	45	895	620	-141	-275	89	59
	Th	476	1200	1300	950	480	6.2	6.8	34	34	1135	890	-117	-245	1010	785	-107	-225	89	88
	F	477	1200	1250	930	510	6.2	6.8	34	34	1060	1110	24	50	965	865	-48	-100	91	78
	Sa	366					6.3	6.8	35	34										
	Su	327					6.2	6.9	33	33										
	AVG	362	1030	1330	806	264	6.2	6.9	33	33	944	918	-9	-26	849	663	-67	-186	90	72
19/11	M	328	850	1100	720	300	6.1	6.9	33	33	810	567	-80	-243	705	457	-81	-248	87	81
	Tu	334	1100	1050	1010	350	5.9	6.8	35	34	1168	575	-198	-593	1034	475	-186	-559	89	83
	W	300	1250	1300	1000	420	6.3	6.8	35	34	1095	765	-99	-330	970	635	-100	-335	89	83
	Th	236	1150	1250	840	330	6.3	6.9	34	34	915	690	-53	-225	805	560	-58	-245	88	81
	F	226	1100	1250	780	300	6.3	6.9	33	34	865	570	-67	-295	715	460	-58	-255	83	81
	Sa	197					6.3	6.9	34	33										
	Su	81					6.0	7.0	32	34										
	AVG	243	1090	1190	870	340	6.2	6.9	34	34	971	633	-82	-337	846	517	-80	-328	87	82

REACTOR: FIXED FILM OPERATING DATA Page 29 MONTH:NOV 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
26/11	M	227	1350	1700	1090	150	6.3	7.0	30	32	1083	690	-89	-393	978	530	-102	-448	90	77
	Tu	268	1200	1500	890	280	6.2	7.0	32	32	1008	790	-58	-218	902	665	-63	-237	89	84
	W	137	1450	1450	1070	390	6.3	6.9	33	32	1227	790	-60	-437	1079	675	-55	-404	88	85
	Th	108	1400	1500	1040	250	6.3	7.0	33	32	1186	590	-65	-596	966	470	-54	-496	81	80
	F	154	1350	1550	1050	220	6.3	7.0	33	32	1132	735	-61	-397	994	575	-64	-419	88	78
	Sa																			
	Su																			
	AVG	179	1350	1540	1028	258	6.3	7.0	32	32	1127	719	-73	-408	984	583	-72	-401	87	81

APPENDIX 3

UASB REACTOR: PERFORMANCE AND OPERATING RECORDS

REACTOR: SLUDGE BED PERFORMANCE DATA Page 1 MONTH:MAY/JUNE 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
	Calculations based on reactor volume of 413 cubic meters. Acclimated sludge imported from Holland for startt-up-130 m^3.														
16/05	M	11	1110	1500			0.03	0.04					0		
	Tu	20	1800	2440			0.09	0.12					0		
	W	50	2290	3670			0.28	0.44					0		
	Th	28	1700	2870		632	0.12	0.19			0.15	78	89		1.42
	F	82	1530	2370		456	0.30	0.47			0.38	81	127		0.81
	Sa	232											154		
	Su	4											106		
	AVG	61	1686	2570		544	0.25	0.38			0.30	79	68		0.55
	Spill 5 cubic metres of milk on 17/05. COD increased temporarily from 2440 to 4630 mg/L.														
23/05	M	0											76		
	Tu	32											67		
	W	101	2356	3257	174	219	0.58	0.80	0.53	93	0.74	93	106	0.48	0.35
	Th	31	3616	5480	219	311	0.27	0.41	0.25	94	0.39	94	80	0.76	0.50
	F	242	2941	4353	859	950	1.72	2.55	1.22	71	1.99	78	137	0.27	0.17
	Sa	0											81		
	Su	0											39		
	AVG	58	2971	4363	417	493	0.42	0.61	0.36	86	0.54	89	84	0.57	0.37
30/05	M	48											49		
	Tu	76	1804	2946	384	429	0.33	0.54	0.26	79	0.46	85	57	0.53	0.30
	W	126	1876	3127		451	0.57	0.95			0.82	86	101	0.43	0.30
	Th	330	1381	2124		451	1.10	1.70			1.34	79	144	0.32	0.26
	F	423											154		
	Sa	185											123		
	Su	185											122		
	AVG	196	1687	2732	384	444	0.80	1.30	0.62	77	1.09	84	107	0.42	0.24
	Interlocked feed pumps to shut off if basin pH greater than 9 or less than 6.														

REACTOR: SLUDGE BED PERFORMANCE DATA Page 2 MONTH: JUNE 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
06/06	M	185	1600	2200	140	200	0.72	0.99	0.65	91	0.90	91	89	0.33	0.24
	Tu	188											112		
	W	282	2200	2766	175	213	1.50	1.89	1.38	92	1.74	92	304	0.53	0.42
	Th	343	2000	3166	170	260	1.66	2.63	1.52	92	2.41	92	253	0.40	0.25
	F	239											244		
	Sa	310											288		
	Su	360											240		
	AVG	272	1933	2711	162	224	1.28	1.79	1.17	92	1.64	92	219	0.45	0.32

Some feed piping blocked temporarily on 08/06 and cleared with recycle pump on 10/06.

13/06	M	238	565	351	180	230	0.33	0.20	0.22	68	0.07	34	235	2.56	8.16
	Tu	454	450	273	130	240	0.49	0.30	0.35	71	0.04	12	327	2.25	21.83
	W	471	360	102	130	265	0.41	0.12	0.26	64	-0.19	-160	311	2.87	-4.05
	Th	486	565	339	135	265	0.66	0.40	0.51	76	0.09	22	353	1.69	9.82
	F	632	555	330	800	540	0.85	0.50	-0.37	-44	-0.32	-64	398	-2.57	-3.00
	Sa	452											272		
	Su	134											273		
	AVG	410	499	279	275	308	0.49	0.28	0.22	45	-0.03	-10	310	3.38	-26.09

Gas volumes to this date are minimums as some gas was escaping from relief valves.
The influent filtrable and total COD results may be reversed for week of 13/06.

20/06	M	181	1660	2667	160	210	0.73	1.17	0.66	90	1.08	92	170	0.63	0.38
	Tu	434	2100	3000	140	360	2.21	3.15	2.06	93	2.77	88	355	0.42	0.31
	W	526	1360	2300	120	230	1.73	2.93	1.58	91	2.64	90	375	0.57	0.34
	Th	479	740	1067	80	160	0.86	1.24	0.77	89	1.05	85	283	0.90	0.65
	F	182											165		
	Sa	256													
	Su	256													
	AVG	331	1465	2259	125	240	1.17	1.81	1.07	91	1.62	89	270	0.61	0.40

No flow into the equalizing basin on 22/06 and 23/06.

REACTOR: SLUDGE BED PERFORMANCE DATA Page 3 MONTH:JUNE/JULY 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
		(m^3/d)	Filt (mg/L)	Total (mg/L)	Filt (mg/L)	Total (mg/L)	Filt (Kg/m^3d)	Total (Kg/m^3d)	Filt (Kg/m^3d)	Filt (%)	Total (Kg/m^3d)	Total (%)	(ACTUAL VOL) (m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
27/06	M	256	1840	3587	250	340	1.14	2.22	0.99	86	2.01	91		0.00	0.00
	Tu	322	2100	3333	280	430	1.64	2.60	1.42	87	2.26	87	247	0.42	0.26
	W	625	2040	2867	390	450	3.09	4.34	2.50	81	3.66	84	511	0.50	0.34
	Th	558	1300	2100	220	410	1.76	2.84	1.46	83	2.28	80	574	0.95	0.61
	F	813											781		
	Sa	704											574		
	Su	817											808		
	AVG	585	1820	2972	285	408	2.58	4.21	2.17	84	3.63	86	583	0.65	0.39
04/07	M	668	1080	2967	190	600	1.75	4.80	1.44	82	3.83	80	513	0.86	0.32
	Tu	717	1240	3067	190	570	2.15	5.32	1.82	85	4.33	81	407	0.54	0.23
	W	811	1160	2433	150	610	2.28	4.78	1.98	87	3.58	75	546	0.67	0.37
	Th	884	1540	2850	160	660	3.30	6.10	2.95	90	4.69	77	601	0.49	0.31
	F	863	1680	3367	150	710	3.51	7.04	3.20	91	5.55	79	1006	0.76	0.44
	Sa	751											780		
	Su	680											974		
	AVG	768	1340	2937	168	630	2.49	5.46	2.18	87	4.29	79	690	0.77	0.39
11/07	M	594	860	1783	140	580	1.24	2.56	1.04	84	1.73	67	448	1.05	0.63
	Tu	0											100		
	W	37											36		
	Th	533	2010	2633	610	870	2.59	3.40	1.81	70	2.28	67	129	0.17	0.14
	F	828	2240	3867	1010	1400	4.49	7.75	2.47	55	4.95	64	325	0.32	0.16
	Sa	671											381		
	Su	240											293		
	AVG	415	1703	2761	587	950	1.71	2.77	1.12	66	1.82	66	245	0.53	0.33

A spill of 1.8 cubic meters of 50 percent caustic on 11/07 caused at least 3 days of upset.
Feed pumps stopped on Sunday.

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 4 | MONTH:JULY/AUG 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
18/07	M	240	1600	2500	171	307	0.93	1.45	0.83	89	1.27	88	45	0.13	0.09
	Tu	727	1300	1800	172	600	2.29	3.17	1.99	87	2.11	67	266	0.32	0.30
	W	715	1800	2850	429	643	3.12	4.93	2.37	76	3.82	77	198	0.20	0.13
	Th	736	1800	3100	200	529	3.21	5.52	2.85	89	4.58	83	339	0.29	0.18
	F	701											301		
	Sa	225													
	Su	225													
	AVG	510	1625	2563	243	520	2.01	3.16	1.71	85	2.52	80	230	0.33	0.22

Gas leaking from domes in the sludge bed reactor all week.
Gas domes under repair on sludge bed reactor week of 25/07. Feed shut off.

01/08	M	0													
	Tu	639		2500		543		3.87			3.03	78	309		0.25
	W	378		2763		1100		2.53			1.52	60	285		0.45
	Th	468	2000	3288	336		2.27	3.73	1.89	83			278	0.36	
	F	604	1650	2750	343	414	2.41	4.02	1.91	79	3.42	85	475	0.60	0.34
	Sa	353											246		
	Su	342											235		
	AVG	398	1825	2825	340	686	1.76	2.72	1.43	81	2.06	76	305	0.52	0.36

Sludge blocking one of the gas domes was causing gas to escape.

REACTOR: SLUDGE BED — PERFORMANCE DATA — Page 5 — MONTH:AUG/DEC 83

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL.)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
08/08	M	14	2050	3250			0.08	0.13							
	Tu	0	2800	3700			0.00	0.00					5		
	W	0	1950	3450			0.00	0.00							
	Th	718	1600	2850	800	1071	2.78	4.95	1.39	50	3.09	62	137	0.24	0.11
	F	694	1900	3150			3.19	5.29					85		
	Sa	0													
	Su	0											21		
	AVG	204	2060	3280	800	1071	1.02	1.62	0.62	61	1.09	67	62	0.24	0.14

Sludge bed reactor shut down from 12/08 to 21/11 in order to wait for the installation of the acid and lime control systems as the pH variations in the equalizing basin were creating problems with rising sludge.
In-plant changes were made to collect caustic wash solutions from evaporators and then to discharge slowly by gravity during several hours. This eliminated periodic surges of high pH in the equalizing tank.

28/11	M	0	4000	5150			0.00	0.00							
	Tu	121	1770	3550			0.52	1.04							
	W	130	1715	2600			0.54	0.82							
	Th	249	2465	3375			1.49	2.03							
	F	298	2150	3300			1.55	2.38							
	Sa	39													
	Su	0													
	AVG	120	2420	3595			0.70	1.04							

Starting 29/11, the sludge bed reactor was operated in recirculation with the sludge storage tank.

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
	Whey spill of 82 cubic meters on 14 Dec.														
19/12	M	0		10400				0.00							
	Tu	0	3775	6300	4150	4800	0.00	0.00	0.00	-10	0.00	24			
	W	234	2225	3600	1138	1825	1.26	2.04	0.62	49	1.01	49	28	0.11	0.07
	Th	529	1925	2825	875	2625	2.47	3.62	1.34	55	0.26	7	299	0.54	2.83
	F	356	2675	4600	725	1925	2.31	3.97	1.68	73	2.31	58	274	0.39	0.29
	Sa	204											220		
	Su	225											153		
	AVG	221	2650	5545	1722	2794	1.42	2.97	0.50	35	1.47	50	195	0.95	0.32
	Whey spill of 300 cubic meters on 19/12.														
26/12	M	179											124		
	Tu	204	1294	2963	288	625	0.64	1.46	0.50	78	1.15	79	64	0.31	0.13
	W	716	1925	2975	975	2425	3.34	5.16	1.65	49	0.95	18	33	0.05	0.08
	Th	566	1065	2100	913	1563	1.46	2.88	0.21	14	0.74	26	8	0.09	0.03
	F	274	906	1950	663	1182	0.60	1.29	0.16	27	0.51	39	2	0.03	0.01
	Sa	199											0		
	Su	136											0		
	AVG	325	1298	2497	710	1449	1.02	1.96	0.46	45	0.82	42	33	0.17	0.10
	Gas meter appeared to be malfunctioning giving low gas readings. Meter cleaned later in February.														
02/01	M	75													
	Tu	106	2400	3850	604	1263	0.62	0.99	0.46	75	0.66	67		0.00	0.00
	W	11	2313	3625	775	1425	0.06	0.10	0.04	66	0.06	61	2		
	Th		1788	3000	675	1038				62		65	2		
	F		1925	3025	600	850				69		72			
	Sa														
	Su														
	AVG	64	2107	3375	664	1144	0.33	0.52	0.22	69	0.35	66	2	0.02	0.01

REACTOR: SLUDGE BED PERFORMANCE DATA Page 12 MONTH:JAN/MARCH 84

DATE	DAY	FLOW	CODin		CODout		LOAD			REMOVAL			GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total		Filt	Total			(ACTUAL VOL)	
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
09/01	M		725	1525	300	500				59		67	0		
	Tu		1050	2325	340	455				68		80	0		
	W		900	2100	315	433				65		79	0		
	Th	82	1150	2300	345	515	0.23	0.46	0.16	70	0.35	78	0	0.00	0.00
	F	133	1700	2500	515	775	0.39	0.81	0.22	57	0.56	69	0	0.00	0.00
	Sa	145											0		
	Su	127											0		
	AVG	122	1005	2150	363	536	0.30	0.63	0.19	64	0.48	75	0	0.00	0.00
16/01	M	114	862	1725			0.24	0.48					0		
	Tu	56	950	1938			0.13	0.26					0		
	W	20	1500	2675			0.07	0.13					0		
	Th		1575	2750									0		
	F		1425	2463									0		
	Sa												0		
	Su												0		
	AVG	63	1262	2310			0.19	0.35					0		

Sludge blanket reactor shut down from 16/01 to 06/03. Awaiting final testing of new pH systems.

05/03	M		515	1020											
	Tu	13	1325	2800	295	545	0.04	0.09	0.03	78	0.07	81			
	W		1838	3200	315	620				83		81			
	Th	178	1950	3100			0.84	1.34					5		
	F	14	2325	3800			0.08	0.13					9		
	Sa														
	Su														
	AVG	68	1591	2784	305	583	0.26	0.46	0.21	81	0.36	79	7	0.08	0.05

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 15 | MONTH:MARCH 84

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
12/03	M	0	1538	2775			0.00	0.00							
	Tu	39	1363	2375			0.13	0.22					1		
	W	104	1175	2275	210	350	0.30	0.57	0.24	82	0.48	85	3	0.03	0.01
	Th	24	3800	6000	515	760	0.22	0.35	0.19	86	0.30	87	50	0.63	0.40
	F	26	2378	3800	270	550	0.15	0.24	0.13	89	0.20	86	1	0.02	0.01
	Sa	0													
	Su	3													
	AVG	28	2051	3445	332	553	0.14	0.23	0.12	84	0.20	84	14	0.29	0.17
	Lime usage of 150 minutes on 15 March.														
19/03	M	60	4500	7000	124	360	0.65	1.02	0.64	97	0.96	95	5	0.02	0.01
	Tu	58	2475	3950	145	398	0.35	0.55	0.33	94	0.50	90	5	0.04	0.02
	W	140	2075	3650	115	313	0.70	1.24	0.66	94	1.13	91	0	0.00	0.00
	Th	176	3000	4750	125	350	1.28	2.02	1.23	96	1.88	93	102	0.20	0.13
	F	177	2075	3600	143	398	0.89	1.54	0.83	93	1.37	89	146	0.43	0.26
	Sa	150											42		
	Su	77											31		
	AVG	120	2825	4590	130	364	0.82	1.33	0.78	95	1.23	92	47	0.15	0.09
	Lime feed on 41 minutes on 22 and 23 of March.														
26/03	M	194	900	2450	95	248	0.42	1.15	0.38	89	1.03	90	81	0.52	0.19
	Tu	195	1335	2650	85	238	0.63	1.25	0.59	94	1.14	91	61	0.25	0.13
	W	199	1525	2850	68	220	0.73	1.37	0.70	96	1.27	92	125	0.43	0.24
	Th	199	1663	2575	69	210	0.80	1.24	0.77	96	1.14	92	84	0.26	0.18
	F	54	1775	2675	73	270	0.23	0.35	0.22	96	0.31	90	31	0.34	0.24
	Sa	0													
	Su	0													
	AVG	120	1440	2640	78	237	0.42	0.77	0.40	95	0.70	91	76	0.47	0.26

The flow to the reactor in April included feed from the equalizing basin as shown plus approximately 700 cubic meters a day recycle from the decant tank.

REACTOR: SLUDGE BED PERFORMANCE DATA Page 16 MONTH:APRIL 84

DATE	DAY	FLOW	CODin		CODout		LOAD			REMOVAL			GAS PRODUCTION		
		(m^3/d)	Filt (mg/L)	Total (mg/L)	Filt (mg/L)	Total (mg/L)	Filt (Kg/m^3d)	Total (Kg/m^3d)	Filt (Kg/m^3d)	Filt (%)	Total (Kg/m^3d)	Total (%)	(ACTUAL VOL) (m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
02/04	M	59	1188	2125	85	245	0.17	0.30	0.16	93	0.27	88	7	0.11	0.06
	Tu	114	2288	3600	75	260	0.63	0.99	0.61	97	0.92	93	13	0.05	0.03
	W	55	2525	3900	95	273	0.34	0.52	0.32	96	0.48	93	2	0.01	0.01
	Th	157	1913	3000	95	243	0.73	1.14	0.69	95	1.05	92	29	0.10	0.07
	F	20	1125	2125	75	230	0.05	0.10	0.05	93	0.09	89	2	0.10	0.05
	Sa														
	Su												19		
	AVG	81	1808	2950	85	248	0.35	0.58	0.34	95	0.53	92	12	0.09	0.05
	Lime feed operated for 32 minutes Tuesday 3 April.														
09/04	M	0	1663	2525	95	260	0.00	0.00	0.00	94	0.00	90	2		
	Tu	19	1600	2575	90	230	0.07	0.12	0.07	94	0.11	91			
	W	50	2475	3675	93	240	0.30	0.44	0.29	96	0.42	93	3	0.03	0.02
	Th	47	2275	3575	80	205	0.26	0.41	0.25	96	0.38	94	3	0.03	0.02
	F	48	1725	2875	80	193	0.20	0.33	0.19	95	0.31	93	3	0.04	0.02
	Sa														
	Su														
	AVG	33	1948	3045	80	226	0.15	0.24	0.15	96	0.22	93	3	0.05	0.03
16/04	M	97	1588	2463	78	170	0.37	0.58	0.35	95	0.54	93	4	0.03	0.02
	Tu	166	1800	3075	123	280	0.72	1.24	0.67	93	1.12	91	56	0.20	0.12
	W	18	2050	3400	175	375	0.09	0.15	0.08	91	0.13	89	35	1.04	0.64
	Th	27	2088	3300	74	165	0.14	0.22	0.13	96	0.20	95	0	0.00	0.00
	F	70	2325	3650	69	130	0.39	0.62	0.38	97	0.60	96	0	0.00	0.00
	Sa	121		3500				1.03					24		
	Su	106		2225				0.57					10		
	AVG	86	1970	3088	104	224	0.41	0.65	0.39	95	0.60	93	18	0.11	0.07

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 17 | MONTH:APR/MAY 84

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
23/04	M	51	900	1900	67	133	0.11	0.23	0.10	93	0.22	93	0	0.00	0.00
	Tu	80	1463	2625	67	133	0.28	0.51	0.27	95	0.48	95	3	0.03	0.02
	W	44	1125	2025	60	124	0.12	0.22	0.11	95	0.20	94	37	0.79	0.44
	Th	146	1225	2375	67	138	0.43	0.84	0.41	95	0.79	94	23	0.14	0.07
	F	102	2288	3675	63	124	0.57	0.91	0.55	97	0.88	97	48	0.21	0.13
	Sa	89		3550				0.77					26		
	Su	111		2950				0.79					50		
	AVG	89	1400	2729	65	130	0.30	0.59	0.29	95	0.56	95	27	0.22	0.13

Whey spill of 14 cubic meters 23 April at 16:00 hrs plus 16 cubic meters of whole milk on 29 April.

Flow to the reactor in May was pumped from the treated effluent line of the fixed film reactor. Feed from the equalization basin was discontinued except for a few days at the end of May when a small amount of basin feed was added.

30/04	M	66	590	1320	60	123	0.09	0.21	0.08	90	0.14	91	51	1.46	0.65
	Tu	305	530	1130	69	127	0.39	0.83	0.34	87	0.56	89	89	0.63	0.29
	W	150	555	1055	68	150	0.20	0.38	0.18	88	0.25	86	46	0.63	0.34
	Th	232	348	775	53	100	0.20	0.44	0.17	85	0.28	87	67	0.98	0.43
	F	83	345	770	49	115	0.07	0.15	0.06	86	0.10	85	24	0.98	0.44
	Sa	4											0		
	Su	182											23		
	AVG	146	474	1010	60	123	0.17	0.36	0.15	87	0.24	88	43	0.71	0.43

Lime feed operated 50 minutes during the weekend of 5-6 April.

REACTOR: SLUDGE BED PERFORMANCE DATA Page 18 MONTH:MAY 84

DATE	DAY	FLOW	CODin		CODout		LOAD		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
07/05	M	129	600	1150	55	158	0.19	0.36	0.17	91	0.31	86	71	1.01	0.55
	Tu	150	360	750	50	145	0.13	0.27	0.11	86	0.22	81	44	0.95	0.48
	W	75	335	700	60	130	0.06	0.13	0.05	82	0.10	81	26	1.26	0.61
	Th	132	455	880	65	127	0.15	0.28	0.12	86	0.24	86	45	0.87	0.45
	F	84	280	600	63	126	0.06	0.12	0.04	78	0.10	79	22	1.21	0.55
	Sa	75											13		
	Su	150											0		
	AVG	114	406	816	59	137	0.11	0.22	0.10	86	0.19	83	32	1.06	0.53
	Caustic spill in the plant between 11:00 pm and midnight on 12 May.														
14/05	M	72	310	710	47	110	0.05	0.12	0.05	85	0.10	85	20	1.06	0.46
	Tu	138	168	490	60	127	0.06	0.16	0.04	64	0.12	74	55	3.69	1.10
	W	145	450	950	60	135	0.16	0.33	0.14	87	0.29	86	86	1.52	0.73
	Th	28	465	950	63	145	0.03	0.06	0.03	86	0.05	85	155	13.77	6.88
	F	120	345	770	85	480	0.10	0.22	0.08	75	0.08	38	184	5.90	5.29
	Sa	36											141		
	Su	0											54		
	AVG	77	348	774	63	199	0.06	0.14	0.05	82	0.11	74	99	4.53	2.24

Between 22 May and 15 June the flow to the sludge bed reactor was a combination of treated effluent from the fixed film reactor and some effluent from the equalization basin.
No useful performance data for this period.

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 20 | MONTH:JUNE/JULY 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
	Stopped using effluent from fixed film reactor and returned to feeding from equalization basin. Gas in fixed film effluent caused turbulence and solids carryover.														
18/06	M	421	1150	1975	75	290	1.17	2.01	1.10	93	1.72	85	281	0.62	0.40
	Tu	163	1588	2750	63	393	0.63	1.09	0.60	96	0.93	86	188	0.76	0.49
	W	224	1420	2400	62	240	0.77	1.30	0.74	96	1.17	90	206	0.68	0.43
	Th	201	2375	3550	80	468	1.15	1.72	1.11	97	1.50	87	227	0.49	0.37
	F	168	2325	3425	80	490	0.95	1.40	0.92	97	1.20	86	203	0.54	0.41
	Sa	247		3150				1.89					222		
	Su	166		2325				0.93					177		
	AVG	227	1772	2796	72	376	0.97	1.54	0.93	96	1.33	87	215	0.56	0.39
25/06	M	237	2000	3550	105	293	1.15	2.03	1.09	95	1.87	92	145	0.32	0.19
	Tu	123	1850	3150	80	355	0.55	0.94	0.53	96	0.83	89	154	0.71	0.45
	W	225	1600	2900	73	765	0.87	1.58	0.83	95	1.16	74	188	0.55	0.39
	Th	248	1485	3575	90	605	0.89	2.15	0.84	94	1.78	83	200	0.58	0.27
	F	247	1588	3575	108	820	0.95	2.13	0.88	93	1.64	77	285	0.78	0.42
	Sa	52		3650				0.46					129		
	Su	133		2800				0.90					144		
	AVG	180	1705	3314	91	568	0.74	1.45	0.71	95	1.20	83	178	0.61	0.36
02/07	M	125		3000				0.91					130		
	Tu	178		3000				1.29					165		
	W	74		2550				0.46							
	Th	423	1670	2800	100	290	1.71	2.87	1.61	94	2.57	90	313	0.47	0.29
	F	280		3300		580		2.24			1.84	82	327		0.43
	Sa	154		2900		460		1.08			0.91	84	177		0.47
	Su	210		3400		470		1.73			1.49	86	171		0.28
	AVG	206	1670	2993	100	450	0.83	1.49	0.78	94	1.27	85	214	0.66	0.41

Leakage of gas on Wednesday 4 July. Value not used in weekly average.

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 21 | MONTH: JULY 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
09/07	M	334		2350		265		1.90			1.69	89	336		0.48
	Tu	304		3400		340		2.50			2.25	90	333		0.36
	W	284		2500		420		1.72			1.43	83	304		0.51
	Th	296		2500		235		1.79			1.62	91	333		0.50
	F	262		3400	120	365		2.16			1.93	89	230		0.29
	Sa	137		3300		350		1.10			0.98	89	113		0.28
	Su	170											132		
	AVG	255		2908	120	329		1.80			1.59	89	254		0.39
16/07	M	332	1820	2950	110	390	1.46	2.37	1.37	94	2.06	87	260	0.46	0.31
	Tu	315	1825	3050	90	290	1.39	2.33	1.32	95	2.10	90	224	0.41	0.26
	W	277	1488	2563	95	400	1.00	1.72	0.94	94	1.45	84	246	0.64	0.41
	Th	261	1600	2600	80	560	1.01	1.64	0.96	95	1.29	78	169	0.43	0.32
	F	250	1375	2450	110	440	0.83	1.48	0.77	92	1.22	82	23	0.07	0.05
	Sa	77		6800	195			1.27					12		
	Su	126		5800		290		1.78			1.69	95	79		0.11
	AVG	234	1622	3745	113	395	0.92	2.12	0.85	93	1.90	89	145	0.41	0.18
	Lime feed operated 296 minutes on Saturday 21 July.														
23/07	M	258	1788	3025	105	420	1.12	1.89	1.05	94	1.63	86	167	0.38	0.25
	Tu	250	1850	3150	115	395	1.12	1.90	1.05	94	1.67	87	129	0.30	0.19
	W	110	1540	2800	110	480	0.41	0.74	0.38	93	0.62	83	55	0.35	0.22
	Th	284	3050	5300	120	630	2.10	3.64	2.01	96	3.21	88	240	0.29	0.18
	F	216	1813	3250	120	530	0.95	1.70	0.89	93	1.42	84	255	0.70	0.43
	Sa	103		3850				0.96					143		
	Su	176		4400				1.88					182		
	AVG	199	2008	3682	114	491	0.97	1.78	0.91	94	1.54	87	167	0.44	0.26
	Lime feed operated 36 minutes Thursday 26 July.														

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 22 | MONTH: JULY/AUGUST 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
30/07	M	274	1600	2950	120	415	1.06	1.96	0.98	93	1.68	86	199	0.49	0.29
	Tu	255	1800	3200	138	350	1.11	1.97	1.02	92	1.76	89	232	0.55	0.32
	W	264	2000	3600	125	380	1.28	2.30	1.20	94	2.05	89	251	0.51	0.30
	Th	235	1930	3500	120	720	1.10	1.99	1.03	94	1.58	79	257	0.61	0.39
	F	245	1963	3275	120	390	1.16	1.94	1.09	94	1.71	88	233	0.52	0.33
	Sa	129											144		
	Su	266											166		
	AVG	238	1859	3305	125	451	1.07	1.91	1.00	93	1.65	86	212	0.51	0.31
06/08	M	313	2325	3700	128	425	1.76	2.80	1.66	94	2.48	89	258	0.38	0.25
	Tu	364	1650	2775	125	750	1.46	2.45	1.34	92	1.79	73	217	0.39	0.29
	W	339	1763	3200	120	880	1.45	2.63	1.35	93	1.90	73	295	0.53	0.38
	Th	355	1613	3075	125	640	1.39	2.64	1.28	92	2.09	79	309	0.58	0.36
	F	237	1850	3300	80	435	1.06	1.89	1.02	96	1.64	87	213	0.51	0.31
	Sa	224		3950									197		
	Su	229		4575									123		
	AVG	294	1840	3511	116	626	1.31	2.50	1.23	94	2.06	82	230	0.45	0.27
13/08	M	238	1750	2963	135	765	1.01	1.71	0.93	92	1.27	74	128	0.33	0.24
	Tu	238	1575	2925	120	320	0.91	1.68	0.84	92	1.50	89	225	0.65	0.36
	W	229	2000	3550	113	455	1.11	1.97	1.05	94	1.72	87	228	0.53	0.32
	Th	194	2475	3650	118	870	1.16	1.72	1.11	95	1.31	76	159	0.35	0.29
	F	161	1963	3100	113	360	0.77	1.21	0.72	94	1.07	88	97	0.33	0.22
	Sa	140		3000									138		
	Su	158		4600									119		
	AVG	194	1953	3398	120	554	0.92	1.60	0.86	94	1.34	84	156	0.44	0.28

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 23 | MONTH:AUGUST/SEPT 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
20/08	M	131	1950	3600	120	300	0.62	1.14	0.58	94	1.05	92	116	0.48	0.27
	Tu	107	2225	3650	140	455	0.58	0.95	0.54	94	0.83	88	28	0.13	0.08
	W	109	2000	3525	125	550	0.53	0.93	0.49	94	0.78	84	10	0.05	0.03
	Th	109	1600	2725	120	270	0.42	0.72	0.39	93	0.65	90	14	0.09	0.05
	F	110	1520	3050	130	310	0.40	0.81	0.37	91	0.73	90	126	0.82	0.42
	Sa	105		3125				0.79					152		
	Su	109		3400				0.89					40		
	AVG	111	1859	3296	127	377	0.50	0.89	0.47	93	0.79	89	69	0.36	0.21

Lime feed operated 95 minutes on Thursday and Friday, 30 and 31 August.

27/08	M	109	1400	2500	135	385	0.37	0.66	0.33	90	0.56	85	84	0.61	0.36
	Tu	92	1800	3100	124	325	0.40	0.69	0.37	93	0.62	90	153	0.99	0.60
	W	233	1725	2900	125	395	0.97	1.64	0.90	93	1.42	86	53	0.14	0.09
	Th	146	2800	4550	125	830	0.99	1.61	0.95	96	1.32	82	85	0.22	0.16
	F	109	2200	3550	105	425	0.58	0.93	0.55	95	0.82	88	69	0.30	0.20
	Sa	102		4800				1.19							
	Su	98		3200				0.76							
	AVG	127	1985	3514	123	472	0.61	1.08	0.57	94	0.94	87	89	0.38	0.23

03/09	M	119													
	Tu	129	2125	3450	120	280	0.66	1.08	0.63	94	0.99	92			
	W	134	1975	4050	105	280	0.64	1.32	0.61	95	1.23	93			
	Th	142	1800	3350	290	840	0.62	1.15	0.52	84	0.86	75			
	F	133	1900	3525	145	475	0.61	1.14	0.57	92	0.98	87			
	Sa	143		3250				1.12							
	Su	139		3750				1.26							
	AVG	134	1950	3563	165	469	0.63	1.16	0.58	92	1.01	87	154	0.64	0.37

Starting 3 Sept the gas flow was prorated between the fixed film and sludge bed reactors and on COD filt. removed.

REACTOR: SLUDGE BED — PERFORMANCE DATA — Page 24 — MONTH:SEPTEMBER 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
10/09	M	117	1482	2650	123	360	0.42	0.75	0.38	92	0.65	86			
	Tu	118	1300	3175	115	210	0.39	0.91	0.36	92	0.85	93			
	W	133	1355	3175	90	230	0.44	1.03	0.41	93	0.95	93			
	Th	149	1420	3175	90	450	0.51	1.15	0.48	94	0.99	86			
	F	94	2100	3450	120	570	0.48	0.79	0.45	94	0.66	83			
	Sa	94		3350				0.76							
	Su	93		3175				0.72							
	AVG	114	1547	3164	108	364	0.43	0.87	0.40	93	0.77	88	93	0.57	0.29
17/09	M	94	2400	3750	155	350	0.54	0.85	0.51	94	0.77	91			
	Tu	64	2325	3700	155	340	0.36	0.57	0.33	93	0.52	91			
	W	90	2625	4650	160	430	0.57	1.01	0.54	94	0.92	91			
	Th	90	1850	3350	150	480				92		86			
	F	90	2175	3350	190	285	0.47	0.73	0.43	91	0.67	91			
	Sa	90		3900											
	Su	90													
	AVG	87	2275	3783	162	377	0.48	0.79	0.44	93	0.72	90	89	0.49	0.30
	Flows recorded as approximate at 90 cubic meters/day.														
24/09	M	90	3300	5450	155	250	0.72	1.19	0.69	95	1.13	95			
	Tu	90	4600	7500	145	355	1.00	1.63	0.97	97	1.56	95			
	W	90	3550	5150	150	435	0.77	1.12	0.74	96	1.03	92			
	Th	90	3175	4900	200	560	0.69	1.07	0.65	94	0.95	89			
	F	90	3125	4650	210	310	0.68	1.01	0.64	93	0.95	93			
	Sa	90		4050				0.88							
	Su	90													
	AVG	90	3550	5283	172	382	0.77	1.15	0.74	95	1.07	93	148	0.49	0.34

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 25 | MONTH:OCTOBER 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
01/10	M	90	1375	2450	215	295	0.30	0.53	0.25	84	0.47	88			
	Tu	90	2800	4700	200	360	0.61	1.02	0.57	93	0.95	92			
	W	130	2550	4000	185	300	0.80	1.26	0.74	93	1.16	93			
	Th	190	1950	3000	180	295	0.90	1.38	0.82	91	1.25	90			
	F	117	2100	3600	160	550	0.59	1.02	0.55	92	0.86	85			
	Sa	65		4200				0.66							
	Su	60		8400				1.22							
	AVG	106	2155	4336	188	360	0.55	1.11	0.51	91	1.02	92	120	0.58	0.29
	Magnetic flowmeter replaced vortex meter on feed line because of poor sensitivity of vortex meter at low flow.														
08/10	M	82	4550	6350	215	650	0.90	1.25	0.86	95	1.12	90			
	Tu	100	2500	4000	220	690	0.60	0.97	0.55	91	0.80	83			
	W	139	2375	3950	190	370	0.80	1.33	0.74	92	1.21	91			
	Th	136	2650	4400	175	440	0.87	1.45	0.82	93	1.31	90			
	F	140	2500	4000	185	480	0.85	1.36	0.79	93	1.20	88			
	Sa	130		3300				1.04							
	Su	121		2800				0.82							
	AVG	121	2915	4114	197	526	0.85	1.21	0.80	93	1.05	87	160	0.49	0.37
15/10	M	185	1775	3550	215	490	0.80	1.59	0.70	88	1.37	86			
	Tu	205	2000	3700	155	540	0.99	1.84	0.92	92	1.57	85			
	W	228	1775	3850	175	700	0.98	2.13	0.88	90	1.74	82			
	Th	227	1825	3350	280	680	1.00	1.84	0.85	85	1.46	80			
	F	204	2150	3700	240	820	1.06	1.82	0.94	89	1.42	78			
	Sa	190		4150				1.91							
	Su	190		4200				1.93							
	AVG	204	1905	3786	213	646	0.94	1.87	0.84	89	1.55	83	212	0.61	0.33

REACTOR: SLUDGE BED | PERFORMANCE DATA | Page 26 | MONTH:OCT/NOV 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/l)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
22/10	M	229	1400	2300	225	540	0.78	1.28	0.65	84	0.98	77			
	Tu	193	1900	3800	220	690	0.89	1.77	0.78	88	1.45	82			
	W	207	2125	3850	240	760	1.06	1.93	0.94	89	1.55	80			
	Th	169	2900	4650	225	1000	1.18	1.90	1.09	92	1.49	78			
	F	195	2650	4450	155	580	1.25	2.10	1.18	94	1.82	87			
	Sa	204		3800				1.88							
	Su	176													
	AVG	196	2195	3808	213	714	1.04	1.81	0.94	90	1.47	81	229	0.59	0.38
29/10	M	220	1538	2575	185	285	0.82	1.37	0.72	88	1.22	89			
	Tu	89	1725	3150	145	380	0.37	0.68	0.34	92	0.59	88			
	W	223	2050	4075	155	595	1.11	2.20	1.02	92	1.88	85			
	Th	218	1650	3250	160	550	0.87	1.72	0.79	90	1.43	83			
	F	226	2400	4400	115	665	1.31	2.40	1.25	95	2.04	85			
	Sa	244		3850				2.27							
	Su	223		3550				1.92							
	AVG	206	1873	3550	152	495	0.93	1.77	0.86	92	1.59	86	248	0.70	0.39
05/11	M	258	2650	4500	115	395	1.66	2.81	1.59	96	2.57	91			
	Tu	272	2000	3600	200	435	1.32	2.37	1.19	90	2.09	88			
	W	267	2200	3600	195	530	1.42	2.33	1.30	91	1.98	85			
	Th	259	2800	4450	175	1120	1.76	2.79	1.65	94	2.09	75	358	0.53	0.42
	F	254	2500	4200	200	660	1.54	2.58	1.41	92	2.17	84	233	0.40	0.26
	Sa	229		3600				2.00					280		
	Su	245		2000				1.18					200		
	AVG	255	2430	3707	177	628	1.50	2.29	1.39	93	1.90	83	268	0.47	0.34

REACTOR: SLUDGE BED PERFORMANCE DATA Page 27 MONTH:NOV 84

DATE	DAY	FLOW	CODin		CODout		Load		REMOVAL				GAS PRODUCTION		
			Filt	Total	Filt	Total	Filt	Total	Filt		Total		(ACTUAL VOL)		
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(Kg/m^3d)	(Kg/m^3d)	(Kg/m^3d)	(%)	(Kg/m^3d)	(%)	(m^3/d)	(m^3/Kg CODf)	(m^3/Kg CODt)
12/11	M	245	1138	2025	155	505	0.68	1.20	0.58	86	0.90	75	211	0.88	0.57
	Tu	262	1650	3150	128	410	1.04	1.99	0.96	92	1.73	87	271	0.68	0.38
	W	251	1800	3450	145	450	1.09	2.09	1.00	92	1.82	87	347	0.84	0.46
	Th	242	2200	4150	180	515	1.29	2.43	1.18	92	2.13	88	325	0.67	0.37
	F	226	2100	3850	175	430	1.15	2.11	1.05	92	1.87	89	292	0.67	0.38
	Sa	70		3950				0.67							
	Su	135		2900				0.95							
	AVG	204	1778	3354	157	462	0.88	1.66	0.80	91	1.43	86	284	0.86	0.48
19/11	M	260	1675	2600	305	570	1.05	1.64	0.86	82	1.28	78	217	0.61	0.41
	Tu	270	2200	4800	145	550	1.44	2.48	1.34	93	2.12	86	331	0.60	0.38
	W	235	2175	4000	160	700	1.24	2.28	1.15	93	1.88	83	234	0.49	0.30
	Th	220	2025	3500	145	1220	1.08	1.86	1.00	93	1.21	65	270	0.65	0.54
	F	222	1825	3150	170	560	0.98	1.69	0.89	91	1.39	82	239	0.65	0.42
	Sa	133		3950				1.27					226		
	Su	179		6600				2.85					335		
	AVG	217	1980	3943	185	720	1.04	2.07	0.94	91	1.69	82	265	0.68	0.38
26/11	M	199	2650	4200	200	840	1.28	2.02	1.18	92	1.62	80	296	0.61	0.44
	Tu	206	2150	3550	165	660	1.07	1.77	0.99	92	1.44	81	258	0.63	0.43
	W	203	2550	4300	165	820	1.25	2.11	1.17	94	1.71	81	250	0.52	0.35
	Th	178	2425	4050	180	820	1.05	1.75	0.97	93	1.40	80	253	0.63	0.44
	F	203	2350	4200	170	930	1.16	2.07	1.07	93	1.61	78	299	0.67	0.45
	Sa														
	Su														
	AVG	198	2425	4060	176	814	1.16	1.94	1.08	93	1.55	80	271	0.61	0.42

REACTOR: SLUDGE BED OPERATING DATA Page 1 MONTH:MAY/JUNE 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
16/05	M	11	800		280		7.2		30		500				420				84	
	Tu	20	1000		590		6.5		30		745				630				85	
	W	50	1650		860		7.4	6.6	32	24	1150									
	Th	28	1500	2200	710		8.3	6.7		25	1000	242	-21	-758	810	144	-19	-666	81	60
	F	82	1450	2200	610	100	7.3	7.0		25	880	240	-52	-640	816	116	-57	-700	93	48
	Sa	232					8.2	7.2												
	Su	4					11.4	7.2												
	AVG	61	1280	2200	610	100	8.1	6.9	31	25	855	241	-37	-614	669	130	-38	-683	78	54
23/05	M	0					10.6													
	Tu	32					6.8	7.0		29										
	W	101	1300	1850	690	120	8.7	7.0	30	30	1320	87	-125	-1233	940	41	-91	-899	71	47
	Th	31	2500	1850	1750	140	7.4	7.0		30	2470	66	-75	-2404	1310	45	-39	-1265	53	68
	F	242	2350	2100	1710	160	6.7	7.1	33	29	1320	86	-299	-1234	1140	52	-263	-1088	86	60
	Sa	0					5.2	7.2	35	27										
	Su	0					5.6	7.4	34	28										
	AVG	58	2050	1933	1383	140	7.3	7.1	33	29	1703	80	-94	-1624	1130	46	-63	-1084	66	58
30/05	M	48						7.4		21										
	Tu	76	1350	2250	750	160	7.2	7.1	33	30	880	60	-62	-820	725	38	-52	-687	82	63
	W	126	1400	1900	820	200	7.8	7.1	33	30	1090	64	-129	-1026	880	49	-105	-831	81	77
	Th	330	1000	1700	430	180	7.2	7.0	31	30	683	75	-201	-608	595	49	-180	-546	87	65
	F	423					7.0	7.2	32	31										
	Sa	185						7.0		25										
	Su	185						7.4		20										
	AVG	196	1250	1950	667	180	7.3	7.2	32	27	884	66	-160	-818	733	45	-135	-688	83	68

REACTOR: SLUDGE BED OPERATING DATA Page 2 MONTH: JUNE 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
06/06	M	185					6.7	7.1	27	29	505	86	-78	-419	428	47	-70	-381	85	55
	Tu	188					6.4	7.1	32	28										
	W	282	900	1200	470	100	6.6	7.0	31	30	672	84	-166	-588	600	41	-158	-559	89	49
	Th	343	1000	1200	580	70														
	F	239																		
	Sa	310						7.0	35	35										
	Su	360						7.1	35	32										
	AVG	272	950	1200	525	85	6.6	7.1	32	31	589	85	-137	-504	514	44	-128	-470	87	52
13/06	M	238	1350	1350	1090	100		7.1	31	31	1117	76	-248	-1041	1055	34	-243	-1021	94	45
	Tu	454	1000	1450	460	70		7.3	33	32	775	105	-304	-670	685	59	-284	-626	88	56
	W	471	1100	1300	550	70		7.2	34	32	700	135	-266	-565	600	88	-241	-512	86	65
	Th	486	1700	1250	1245	40		7.0	34	33	1130	108	-497	-1022	990	75	-445	-915	88	69
	F	632	1550	17000	980	140		7.2	34	34	1170	246	-584	-924	710	152	-353	-558	61	62
	Sa	452					6.0	7.6	34	26										
	Su	134					7.0	7.8	30	24										
	AVG	410	1340	4470	865	84	6.5	7.3	33	30	978	134	-346	-844	808	82	-298	-726	83	61
20/06	M	181	950	1650	560	65	6.8	7.2	32	32	560	65	-90	-495	510	34	-86	-476	91	52
	Tu	434	1050	1400	760	75	6.9	6.8	32	32	660	190	-204	-470	620	144	-207	-476	94	76
	W	526	1150	1300	550	150	7.8		34		610	80	-279	-530	530	56	-249	-474	87	70
	Th	479	1250	1450	350	30	7.6				350	54	-142	-296	255	31	-107	-224	73	57
	F	182					8.2		34											
	Sa	256																		
	Su	256																		
	AVG	331	1100	1450	555	80	7.5	7.0	33	32	545	97	-148	-448	479	66	-136	-413	88	68

REACTOR: SLUDGE BED OPERATING DATA Page 3 MONTH:JUNE/JULY 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
27/06	M	256	950	1800	500	80	6.2	7.0	30	31	570	92	-122	-478	500	70	-110	-430	88	76
	Tu	322	1200	1550	810	110	6.4	7.0	32	32	900	120	-251	-780	820	66	-243	-754	91	55
	W	625	1050	1300	720	100	6.4	7.0	32	32	720	126	-371	-594	700	108	-370	-592	97	86
	Th	558	1250	1450	880	100	6.8	7.0	34	32	790	220	-318	-570	730	156	-320	-574	92	71
	F	813					7.6	7.0	33	32										
	Sa	704					6.7	7.2		25										
	Su	817					7.0	7.2		24										
	AVG	585	1113	1525	728	98	6.7	7.1	32	30	745	140	-354	-606	688	100	-344	-588	92	72
04/07	M	668	850	1200	470	80	7.2	7.0	31	31	1070	316	-504	-754	1060	288	-516	-772	99	91
	Tu	717	1050	1150	530	60	7.2	7.0	32	32	970	424	-391	-546	930	352	-414	-578	96	83
	W	811	1110	1200	480	80	7.8	6.8	32	32	830	388	-358	-442	710	336	-303	-374	86	87
	Th	884	1110	1150	610	40	7.0	7.0	34	33	850	408	-391	-442	820	336	-428	-484	96	82
	F	863	1300	1350	700	50	7.3	7.0	33	33	1080	510	-492	-570	1000	425	-496	-575	93	83
	Sa	751					6.0	7.0	33	34										
	Su	680					6.4	7.4	27	33										
	AVG	768	1084	1210	558	62	7.0	7.0	32	33	960	409	-423	-551	904	347	-427	-557	94	85
11/07	M	594	600	1150	130	40	8.0	7.0	28	30	600	485	-68	-115	590	370	-131	-220	98	76
	Tu	0					12.0	7.8	33	24										
	W	37					8.4		32	24										
	Th	533	1000	1300	520	240	7.6	7.0	30	31	367	264	-55	-103	360	244	-62	-116	98	92
	F	828	1050	1400	580	330	7.0	7.0	34	34	636	223	-342	-413	173	173	0	0	27	78
	Sa	670					6.5	7.3	35	26										
	Su	240						7.5		24										
	AVG	415	883	1283	410	203	8.3	7.3	32	28	534	324	-87	-210	374	262	-46	-112	70	81

REACTOR: SLUDGE BED OPERATING DATA Page 4 MONTH: JULY/AUG 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
18/07	M	240	700	1600	450	60	8.2		31		728	112	-148	-616	624	82	-130	-542	86	73
	Tu	727	1250	1450	710	70	7.0	7.3		33	720	274	-324	-446	656	188	-340	-468	91	69
	W	715	1050	1500	590	150	8.4	7.2	32	33	764	214	-393	-550	620	150	-336	-470	81	70
	Th	736	1150	1550	680	50	7.0	7.2	34	33	832	294	-396	-538	720	210	-375	-510	87	71
	F	701																		
	Sa	225																		
	Su	225					7.0	7.2	20	24										
	AVG	510	1038	1525	608	83	7.5	7.2	29	31	761	224	-274	-538	655	158	-254	-498	86	70
	Gas domes under repair during the week of 25/07.																			
01/08	M	0																		
	Tu	639	1200	1250	560	60	7.7	7.2	34	33	768	249	-332	-519	624	220	-258	-404	81	88
	W	378	1120	1300	640	90	7.4	7.7	34	14	742	269	-179	-473	656	173	-183	-483	88	64
	Th	468	1250	1350	780	90	6.9	7.8	35	26	758	371	-181	-387	660	185	-222	-475	87	50
	F	604	1230	1400	615	45	6.7	7.6	36	18	845	213	-382	-632	665	159	-306	-506	79	75
	Sa	353					6.3	7.7	35	27										
	Su	342					9.2	7.9	32	25										
	AVG	398	1200	1325	649	71	7.4	7.7	34	24	778	276	-200	-503	651	184	-186	-467	84	67
08/08	M	16	1250		660		6.9	7.9	32	26	785				745				95	
	Tu	0	1070		645		6.8	8.0	32	23	635				580				91	
	W	0	1020		625		8.0	8.0	33	22	785				730				93	
	Th	719	1120		625		7.0	7.5	31	22	770				715				93	
	F	694	1200		720		6.4	7.6	31	23	865				765				88	
	Sa	0																		
	Su	0																		
	AVG	204	1132		655		7.0	7.8	32	23	768				707				92	

Sludge bed reactor shut down from 12/08 to 21/11 in order to wait for installation of new acid and lime control systems as the pH variations in the equalizing basin were creating problems with rising sludge. Changes in plant during same period to collect caustic wash solutions from evaporator cleaning for gradual discharge during several hours.

REACTOR: SLUDGE BED OPERATING DATA Page 10 MONTH:NOV/DEC 83

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
28/11	M	0					5.7	7.4	33	22									
	Tu	121					6.8	7.4	33	30									
	W	130					6.0	7.4	34	30									
	Th	249					6.8	7.1	34	31									
	F	298					5.8	7.0	34	31									
	Sa	38					6.4	7.0	32	28									
	Su	0					6.9	7.2	30	22									
	AVG	119					6.3	7.2	33	28									
05/12	M	35					6.6	7.4	32	30									
	Tu	290					6.5	7.2	33	32									
	W	247					6.4	7.2	32	31									
	Th	197					6.5	7.2	32	31									
	F	176					6.6		34										
	Sa	124					6.8	7.3	36	32									
	Su	44					6.3	7.4	28	32									
	AVG	159					6.5	7.3	32	31									
12/12	M	116					6.2	7.5	29	30									
	Tu	245					6.5	7.2	32	29									
	W	46					6.2		32										
	Th	46					6.0		33										
	F	46					6.2		34										
	Sa						6.5		33										
	Su						6.8		30										
	AVG	100					6.3	7.4	32	30									

REACTOR: SLUDGE BED OPERATING DATA Page 11 MONTH:DEC 83/JAN 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
19/12	M	0					4.7		39											
	Tu	0	2400	2500	1700	1340	6.0		32		1540	945	0	-595						
	W	234	1300	1950	790	440	6.0	7.2	32	30	840	675	-39	-165	755	440	-74	-315	90	65
	Th	529	1100	1550	690	350	6.6	7.2	32	31	718	1730	535	1012	635	825	101	190	88	48
	F	356	1500	1500	870	260	6.0	7.2	34	32	1160	1415	91	255	1055	765	-103	-290	91	54
	Sa	204					6.2	7.1	32	30										
	Su	225					6.9	7.3	25	32										
	AVG	221	1575	1875	1013	598	6.1	7.2	32	31	1065	1191	28	127	815	677	-31	-138	77	57
26/12	M	179					6.7	7.4	26	29										
	Tu	204	900	1200	360	120	6.8	7.4	29	27	693	273	-86	-420	635	218	-85	-417	92	80
	W	716	1300	1300	730	440	6.8	7.0	32	30	925	1085	115	160	833	790	-31	-43	90	73
	Th	566	950	1150	480	410	7.2	7.2	32	31	758	410	-197	-348	670	358	-177	-312	88	87
	F	274	1050	1150	400	310	6.6	7.2	33	32	653	311	-94	-342	563	267	-81	-296	86	86
	Sa	199					6.9	7.1	33	32										
	Su	135					6.3	7.1	26	32										
	AVG	325	1050	1200	493	320	6.8	7.2	30	30	757	520	-77	-238	675	408	-87	-267	89	79
02/01	M	75					6.3	7.2	24	30										
	Tu	106	1050	1100	390	200	6.2	7.0	31	28	888	377	-54	-511	815	344	-50	-471	92	91
	W	11	1100	1250	750	280	5.9	7.1	33	28	945	363	-6	-582	815	328	-5	-487	86	90
	Th		950	1350	720	300	5.8		34		825	268		-557						
	F		1250	1300	790	270	5.9	7.2	34	31	820	167		-653						
	Sa						7.0	7.2	29	32										
	Su						6.6	7.2	28	32										
	AVG	64	1088	1250	663	263	6.2	7.2	30	30	870	294	-37	-576	815	336	-31	-479	94	114

REACTOR: SLUDGE BED OPERATING DATA Page 12 MONTH:JAN/MARCH 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
09/01	M		750	1100	340	150	7.2	7.2	30	30										
	Tu		1050	1050	530	160	6.3	7.3	32	29										
	W		1050	1050	470	160	6.8	7.5	33	29										
	Th	82	1025	1050	590	190	6.8	7.6	33	29	805	108	-57	-697	700	97	-49	-603	87	90
	F	133	1100	1050	600	250	6.5	7.4	34	29	815	166	-86	-649	720	145	-76	-575	88	87
	Sa	145					6.9	7.2	30	32										
	Su	127					7.0	7.2	24	28										
	AVG	122	995	1060	506	182	6.8	7.3	31	29	810	137	-82	-673	710	121	-72	-589	88	88
16/01	M	114	750	1250	410	520	6.4	7.2	26	28	563	201	-41	-362	510	174	-38	-336	91	87
	Tu	56	950	1250	450	360	6.4	7.2	29	27	658	158	-28	-500	583	140	-25	-443	89	89
	W	20	1150		620		6.2		29		820				760				93	
	Th		1275		680		6.9		30											
	F		1050		630		6.6	6.6	30	27										
	Sa						6.6	7.0	29	28										
	Su						8.8	7.0	25	28										
	AVG	63	1035	1250	558	440	6.8	7.0	28	28	680	180	-32	-501	618	157	-29	-461	91	87
	Sludge bed reactor shut down from 18/01 to 06/03.																			
05/03	M		450		200		7.0		26											
	Tu	13	950	295	520	120	6.9	6.6	32	27	700	175	-7	-525	610	147	-6	-463	87	84
	W		1200	315	760	130	6.6	6.8	34	28	845	281		-564						
	Th	178	1250		820		6.8		34		780				665				85	
	F	14	1280		940		6.3		33		925				820				89	
	Sa						6.5		34											
	Su						6.7		27											
	AVG	68	1026	305	648	125	6.7	6.7	31	28	813	228	-40	-585	698	147	-38	-551	86	64

REACTOR: SLUDGE BED OPERATING DATA Page 15 MONTH:MARCH 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
12/03	M	0	950		650		6.5	6.3	29	27										
	Tu	39	900		570		6.6	6.4	32	27	705				630				89	
	W	104	1000	1100	520	70	7.0	6.4	32	26	675	145	-55	-530	620	125	-51	-495	92	86
	Th	24	1700	1200	1830	240	5.8	6.4	33	28	1440	253	-28	-1187	1270	210	-25	-1060	88	83
	F	26	1350	1350	1070	70	6.3	6.8	33	28	905	275	-16	-630	785	225	-15	-560	87	82
	Sa	0					5.8		34											
	Su	3					6.3		31											
	AVG	28	1180	1217	928	127	6.3	6.5	32	27	931	224	-20	-707	826	187	-18	-640	89	83
19/03	M	60	2500	1350	2120	30	6.3	7.2	34	28	1925	240	-101	-1685	1650	193	-87	-1457	86	80
	Tu	58	1500	1450	1140	50	6.6	7.2	34	28	905	207	-40	-698	805	180	-36	-625	89	87
	W	140	1150	1500	920	20	6.4	7.2	34	29	1035	183	-119	-852	925	168	-106	-757	89	92
	Th	176	1250	1450	1340	40	5.8	7.1	33	30	1200	185	-179	-1015	1090	160	-164	-930	91	86
	F	177	1350	1450	940	80	6.4	7.0	34	31	1105	250	-151	-855	965	193	-137	-772	87	77
	Sa	150					6.9	7.0	38	38										
	Su	77					6.7	7.0	34	33										
	AVG	120	1550	1440	1292	44	6.4	7.1	34	31	1234	213	-122	-1021	1087	179	-109	-908	88	84
26/03	M	194	1050	1450	460	30	7.0	7.0	30	33	965	133	-161	-832	830	113	-139	-717	86	85
	Tu	195	1050	1350	570	40	6.8	7.0	32	32	820	136	-133	-684	730	113	-120	-617	89	83
	W	199	1200	1300	690	40	6.8	7.0	34	32	865	128	-147	-737	760	100	-131	-660	88	78
	Th	199	1250	1300	700	30	7.0	7.0	34	33	735	123	-122	-612	665	106	-111	-559	90	86
	F	54	1350	1300	780	40	7.1	7.0	34	33	715	193	-28	-522	625	144	-26	-481	87	75
	Sa	0					7.1		38											
	Su	0					7.1		33											
	AVG	120	1180	1340	640	36	7.0	7.0	34	33	820	143	-81	-677	722	115	-73	-607	88	81

REACTOR: SLUDGE BED OPERATING DATA Page 16 MONTH:APRIL 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
02/04	M	59	1100	1350	600	30	7.0	7.3	34	32	680	157	-31	-523	575	122	-27	-453	85	78
	Tu	114	1300	1350	1050	30	6.2	7.3	36	31	940	175	-87	-765	815	150	-76	-665	87	86
	W	55	1400	1350	1180	30	6.2	7.2	37	33	995	165	-46	-830	840	138	-39	-702	84	84
	Th	157	1200	1400	880	35	6.8	7.2	34	33	855	125	-115	-730	725	105	-97	-620	85	84
	F	20	1100	1350	600	30	7.2	7.2	34	34	765	135	-13	-630	640	114	-11	-526	84	84
	Sa						6.6	7.2	37	34										
	Su						6.6	7.0	31	34										
	AVG	81	1220	1360	862	31	6.7	7.2	35	33	847	151	-56	-696	719	126	-48	-593	85	83
09/04	M	0	1050	1550	760	40	6.6	7.0	28	32	690	123	0	-567	600	107	0	-493	87	87
	Tu	19	1200	1500	700	30	7.0	7.0	35	32	790	122	-13	-668	640	103	-10	-537	81	84
	W	50	1350	1500	1100	40	6.2	7.2	36	32	840	130	-36	-710	775	114	-33	-661	92	88
	Th	47	1500	1550	1040	40	6.8	7.2	37	32	865	98	-36	-767	745	90	-31	-655	86	92
	F	48	1200	1500	780	40	6.7	7.3	34	32	740	92	-31	-648	660	82	-28	-578	89	89
	Sa						6.9	7.1	35	32										
	Su						6.8	7.2	31	28										
	AVG	33	1260	1520	876	38	6.7	7.1	34	31	785	113	-22	-672	684	99	-19	-585	87	88
16/04	M	97	1000	1500	790	30	6.4	7.4	30	32	670	76	-58	-594	580	62	-50	-518	87	82
	Tu	166	1450	1450	900	65	6.8	7.2	32	31	875	103	-128	-772	775	85	-115	-690	89	83
	W	18	1550	1450	1050	85	7.0	7.0	34	32	945	144	-14	-801	795	110	-12	-685	84	76
	Th	27	1550	1550	1040	30	6.8	7.0	34	32	925	64	-23	-861	800	60	-20	-740	86	94
	F	70	1750	1550	1090	40	7.5	7.1	36	32	995	49	-66	-946	835	44	-55	-791	84	90
	Sa	121		1600		40	6.7	7.1	30	32										
	Su	106		1600		40	6.8	7.1	27	32										
	AVG	86	1460	1529	974	47	6.9	7.1	32	32	882	87	-69	-795	757	72	-59	-685	86	83

REACTOR: SLUDGE BED OPERATING DATA Page 17 MONTH:APR/MAY 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
23/04	M	51	850	1500	420	40	6.8	7.1	30	31	735	60	-34	-675	650	48	-31	-602	88	80
	Tu	80	1250	1450	740	40	7.0	7.1	33	31	760	50	-57	-710	695	41	-52	-654	91	82
	W	44	1050	1400	600	35	7.0	7.1	35	31	635	43	-26	-592	590	40	-24	-550	93	93
	Th	146	1400	1350	710	40	7.8	7.1	37	32	825	56	-112	-769	700	48	-95	-652	85	86
	F	102	1050	1350	1010	30	6.0	7.1	38	33	1010	58	-97	-952	895	49	-86	-846	89	84
	Sa	89		1450		30	6.1	7.0	39	33										
	Su	111		1500		35	6.6	7.0	33	34										
	AVG	89	1120	1429	696	36	6.8	7.1	35	32	793	53	-66	-740	706	45	-59	-661	89	85
30/04	M	66	1000	1400	940	35	6.0	7.0	32	33	1600	59	-102	-1541	1515	49	-97	-1466	95	83
	Tu	305	1300	1450	840	40	6.8	7.0	37	33	790	37	-230	-753	745	37	-216	-708	94	100
	W	150	1300	1450	810	35	6.7	7.0	36	33	745	70	-101	-675	660	56	-91	-604	89	80
	Th	232	1050	1450	790	30	6.4	7.0	34	34	870	45	-191	-825	815	40	-180	-775	94	89
	F	83	1200	1400	760	35	6.6	7.0	37	34	820	52	-64	-768	750	44	-59	-706	91	85
	Sa	4					6.5	7.1	38	34										
	Su	182					7.0	7.2	32	34										
	AVG	146	1170	1430	828	35	6.6	7.0	35	34	965	53	-133	-912	897	45	-124	-852	93	86
07/05	M	129	1350	1400	1300	35	6.4	7.2	30	33	890	87	-104	-803	805	69	-95	-736	90	79
	Tu	150	1150	1350	780	30	6.8	7.1	37	33	775	72	-105	-703	665	63	-90	-602	86	88
	W	75	1100	1350	620	30	6.9	7.1	32	33	648	53	-45	-595	598	48	-41	-550	92	91
	Th	132	1100	1350	720	30	6.6	7.1	33	33	640	44	-79	-596	595	43	-73	-552	93	98
	F	84	950	1300	600	40	6.8	7.1	36	33	545	51	-41	-494	505	46	-39	-459	93	90
	Sa	75		1300		30	6.2	7.1	39	34										
	Su	150		1350		35	10.8	7.2	33	34										
	AVG	114	1130	1343	804	33	7.2	7.1	34	33	700	61	-72	-638	634	54	-66	-580	91	88

REACTOR: SLUDGE BED OPERATING DATA Page 18 MONTH:MAY 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
14/05	M	72	1150	1350	560	30	7.0	7.2	32	34	605	52	-40	-553	515	50	-33	-465	85	96
	Tu	138	1200	1400	430	40	7.4	7.2	36	34	715	40	-93	-675	588	38	-76	-550	82	95
	W	145	1300	1350	780	40	7.2	7.2	37	35	830	61	-112	-769	725	53	-97	-672	87	87
	Th	28	1200	1350	620	30	7.0	7.0	34	35	685	55	-18	-630	625	50	-16	-575	91	91
	F	120	1300	1300	800	60	6.9	7.0	38	36	715	495	-26	-220	665	288	-45	-377	93	58
	Sa	36		1450		40	6.5	6.9	41	34										
	Su	0		1500		40	6.6	6.9	33	34										
	AVG	77	1230	1386	638	40	6.9	7.1	36	35	710	141	-44	-569	624	96	-41	-528	88	68
21/05	M		750	1500	410	40	6.9	6.9	31	34	363	150		-213	318	136		-182	88	91
	Tu		1050	1100	660	35	6.7	6.8	31	33	605	973		368	560	453		-107	93	47
	W		1400	1150	640	40	7.0	6.9	38	33	865	358		-507	800	212		-588	92	59
	Th		900	1300	490	30	6.8	6.8	37	35	555	310		-245	480	180		-300	86	58
	F		1050	1200	640	35	6.7	6.8	37	37	645	180		-465	555	112		-443	86	62
	Sa			1200		35	6.4	6.8	41	38										
	Su			1150		40	6.8	6.8	34	38										
	AVG		1030	1229	568	36	6.8	6.8	36	35	607	394		-212	543	219		-324	89	55

Between 22 May and 15 June the flow to the sludge bed reactor was a combination of treated effluent from the fixed film reactor and some effluent from the equalization basin.

REACTOR: SLUDGE BED OPERATING DATA Page 19 MONTH:MAY/JUNE 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS			VOLATILE SOLIDS (VSS)				
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference	Feed	Effl	Difference	Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
28/05	M		650	1050	360	30	6.8	6.8	31	36	540	91	-449	510	88	-422	94	97
	Tu		700	1000	400	35	6.8	6.8	34	35	490	342	-148	450	192	-258	92	56
	W		1050	1000	700	30	7.0	6.8	36	36	584	286	-298	538	170	-368	92	59
	Th		900	1100	650	70	6.8	7.0	34	36	600	46	-554	542	36	-506	90	78
	F		3700	1300	2920	130	6.8	7.0	36	36	2115	772	-1343	1925	385	-1540	91	50
	Sa			1800		45	6.4	6.9	37	38								
	Su			1900		40	6.6	7.0	30	37								
	AVG		1400	1307	1006	47	6.7	6.9	34	36	866	307	-558	793	174	-619	92	57
04/06	M		1200	1600	900	40	6.6	7.0	30	34	815	64	-751	760	58	-702	93	91
	Tu		1250	1450	710	35	7.0	6.9	35	33	625	65	-560	570	56	-514	91	86
	W		1950	1400	1400	40	6.7	6.9	38	35	1030	79	-951	910	67	-843	88	85
	Th		1200	1450	750	40	6.9	7.0	35	36	663	50	-613	563	40	-523	85	80
	F		1200	1450	760	40	7.0	7.0	38	36	685	89	-596	613	66	-547	89	74
	Sa			1350		40	7.0	7.0	40	38								
	Su			1350		40	7.0	7.0	34	39								
	AVG		1360	1436	904	39	6.9	7.0	36	36	764	69	-694	683	57	-626	89	83
11/06	M		900	1250	170	30	7.4	7.0	32	36	660	92	-568	610	77	-533	92	84
	Tu		900	1200	360	35	7.0	6.8	39	35	665	140	-525	645	109	-536	97	78
	W		850	1175	410	25	7.0	6.9	39	39	552	89	-463	494	67	-427	89	75
	Th		900	1100	560	30	6.6	6.9	38	39	647	127	-520	610	102	-508	94	80
	F		1000	1200	580	30	6.8	6.9	36	38	670	112	-558	595	100	-495	89	89
	Sa			1150		35	6.4	6.8	39	38								
	Su			1400		40	6.4	6.9	35	37								
	AVG		910	1211	416	32	6.8	6.9	37	37	639	112	-527	591	91	-500	92	81

REACTOR: SLUDGE BED OPERATING DATA Page 20 MONTH: JUNE/JULY 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
18/06	M	421	850	1375	530	30	6.9	6.9	34	36	527	110	-176	-417	474	89	-162	-385	90	81
	Tu	163	1200	1200	670	35	6.8	6.8	36	35	715	295	-68	-420	623	174	-73	-449	87	59
	W	224	1250	1300	670	35	6.8	7.0	34	35	585	98	-109	-487	515	71	-99	-444	88	72
	Th	201	1550	1325	1060	40	6.2	7.0	36	35	825	126	-140	-699	725	94	-127	-631	88	75
	F	168	1700	1425	1050	40	6.6	6.8	36	36	770	299	-79	-471	700	178	-88	-522	91	60
	Sa	247					6.8	7.0	40	36										
	Su	166		1500		35	6.8	7.0	33	37										
	AVG	227	1310	1354	796	36	6.7	6.9	36	36	684	186	-113	-499	607	121	-110	-486	89	65
25/06	M	237	1400	1425	900	35	6.6	7.0	35	36	838	130	-167	-708	780	94	-162	-686	93	72
	Tu	123	1200	1400	830	30	6.0	6.9	39	37	868	165	-87	-703	763	127	-78	-636	88	77
	W	225	1250	1400	690	40	6.8	7.0	40	37	655	248	-91	-407	575	182	-88	-393	88	73
	Th	248	1200	1350	640	40	6.8	7.0	40	37	960	275	-170	-685	873	172	-174	-701	91	63
	F	247	1250	1350	750	30	6.6	7.0	34	37	903	358	-134	-545	780	262	-128	-518	86	73
	Sa	52		1400		33	6.7	7.0	40	37		645	34	645		432	22	432		67
	Su	133					6.8	7.2	35	36										
	AVG	180	1260	1388	762	35	6.6	7.0	38	37	845	304	-98	-541	754	212	-98	-543	89	70
02/07	M	125					6.6	7.1	34	32										
	Tu	178					6.8	7.1	37	36										
	W	74					6.9	7.0		38										
	Th	423					6.8	7.2	38	38										
	F	280					6.3	7.0	37	38										
	Sa	154					6.0	7.0	33	38										
	Su	210					6.4	7.0	32	37										
	AVG	206					6.5	7.1	35	37										

REACTOR: SLUDGE BED OPERATING DATA Page 21 MONTH: JULY 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
09/07	M	334					6.7	7.0	32	35										
	Tu	304					6.0	7.1	36	36										
	W	284					6.6	7.0	35	37										
	Th	296					6.8	7.0	36	37										
	F	262					6.4	7.0	37	37										
	Sa	137					6.7	7.1	34	38										
	Su	170					6.6	7.1	32	37										
	AVG	255					6.5	7.0	35	37										
16/07	M	332	1150	1450	750	40	6.4	7.2	33	36	578	130	-149	-448	515	105	-136	-410	89	81
	Tu	315	1300	1350	740	40	6.6	7.0	38	36	790	104	-216	-686	690	96	-187	-594	87	92
	W	277	1250	1300	710	40	6.6	7.0	38	37	673	187	-135	-486	590	151	-122	-439	88	81
	Th	261	1300	1300	780	40	6.7	7.0	33	37	705	225	-125	-480	620	193	-111	-427	88	86
	F	250	1100	1350	660	40	6.6	7.0	37	37	628	190	-109	-438	538	145	-98	-393	86	76
	Sa	77		1650		50	6.2	7.0	41	37										
	Su	126	2050	1800	1660	40	6.4	7.2	34	37										
	AVG	234	1358	1457	883	41	6.5	7.1	36	37	675	167	-119	-508	591	138	-106	-453	88	83
23/07	M	258	1300	1850	880	50	6.8	7.0	31	37	714	174	-139	-540	649	144	-130	-505	91	83
	Tu	250	1500	1550	930	35	6.6	7.0	37	36	761	156	-151	-605	668	133	-134	-535	88	85
	W	110	1250	1500	760	35	6.8	7.0	38	37	728	254	-52	-474	623	181	-48	-442	86	71
	Th	284	1550	1450	1350	40	6.0	7.0	38	37	1380	630	-213	-750	1305	380	-263	-925	95	60
	F	216	1450	1500	830	35	6.8	7.1	35	37	817	402	-90	-415	713	247	-101	-466	87	61
	Sa	103		1450		38	6.3	7.1	38	37										
	Su	176		1550		40	6.2	7.0	36	37										
	AVG	199	1410	1550	950	39	6.5	7.0	36	37	880	323	-111	-557	792	217	-115	-575	90	67

REACTOR: SLUDGE BED OPERATING DATA Page 22 MONTH: JULY/AUGUST 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
30/07	M	274	1300	1600	770	30	6.8	7.0	33	36	621	233	-106	-388	585	161	-116	-424	94	69
	Tu	255	1350	1450	800	35	6.8	7.0	37	37	645	97	-140	-548	558	84	-121	-474	87	87
	W	264	1500	1400	920	40	6.8	7.0	35	36	638	85	-146	-553	533	73	-121	-460	84	86
	Th	235	1450	1400	900	30	6.8	7.0	36	36	633	510	-29	-123	523	307	-51	-216	83	60
	F	245	1450	1450	910	35	6.8	7.0	37	36	618	81	-132	-537	545	74	-115	-471	88	91
	Sa	129		1550		35	6.8	7.1	39	38										
	Su	266					6.6	6.9	36	37										
	AVG	238	1410	1475	860	34	6.8	7.0	36	37	631	201	-102	-430	549	140	-97	-409	87	69
06/08	M	313	1600	1700	1040	35	6.5	7.2	35	36	794	143	-204	-651	706	95	-191	-611	89	66
	Tu	364	1350	1600	790	40	6.8	7.2	36	35	588	613	9	25	485	365	-44	-120	82	60
	W	339	1300	1400	860	40	6.6	7.1	35	35	822	823	0	1	697	465	-79	-232	85	57
	Th	355	1400	1500	820	40	6.6	7.2	36	34	791	364	-152	-427	663	235	-152	-428	84	65
	F	237					6.6	7.2	38	37										
	Sa	224					6.2	7.2	39	37										
	Su	229					6.2	7.1	35	37										
	AVG	294	1413	1550	878	39	6.5	7.2	36	36	749	486	-77	-263	638	290	-102	-348	85	60
13/08	M	238	1200	1650	810	40	6.3	7.1	34	35	592	689	23	97	524	393	-31	-131	89	57
	Tu	238	1300	1550	790	40	6.8	7.1	36	35	671	184	-116	-487	592	132	-109	-460	88	72
	W	229	1350	1450	980	30	6.2	7.0	36	36	762	231	-122	-531	685	178	-116	-507	90	77
	Th	194	1700	1550	1230	30	6.5	7.1	37	35	944	800	-28	-144	791	485	-59	-306	84	61
	F	161	1550	1650	960	30	6.8	7.0	37	35	790	255	-86	-535	670	172	-80	-498	85	67
	Sa	140					6.7	7.3	38	35										
	Su	158					5.8	7.2	35	34										
	AVG	194	1420	1570	954	34	6.4	7.1	36	35	752	432	-62	-320	652	272	-74	-380	87	63

REACTOR: SLUDGE BED OPERATING DATA Page 23 MONTH:AUGUST/SEPT 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
20/08	M	131	1400	1700	890	35	6.6	7.1	35	33	924	184	-97	-740	894	133	-100	-761	97	72
	Tu	107	1650	1700	1110	35	6.7	7.0	36	34	884	315	-61	-569	780	212	-61	-568	88	67
	W	109	1550	1700	960	40	6.7	7.0	36	34	913	321	-64	-592	757	215	-59	-542	83	67
	Th	109	1350	1700	830	35	6.8	7.1	36	34	728	150	-63	-578	613	107	-55	-506	84	71
	F	110	1350	1600	760	25	6.8	7.1	35	33	850	167	-75	-683	718	119	-66	-599	84	71
	Sa	105					6.7	7.2	36	33										
	Su	109					6.8	7.0	36	34										
	AVG	111	1460	1680	910	34	6.7	7.1	36	34	860	227	-70	-632	752	157	-66	-595	88	69
27/08	M	109	1000	1650	660	35	6.7	7.1	32	33	545	216	-36	-329	490	146	-37	-344	90	68
	Tu	92	1350	1600	880	35	6.8	7.2	35	33	830	126	-65	-704	720	103	-57	-617	87	82
	W	233	1200	1450	860	25	6.4	7.2	36	33	710	235	-111	-475	620	164	-106	-456	87	70
	Th	146	1600	1500	1280	35	6.0	7.0	36	35	1100	818	-41	-282	950	473	-70	-477	86	58
	F	109	1350	1550	1100	30	6.0	7.0	36	35	850	283	-62	-567	750	189	-61	-561	88	67
	Sa	102					6.0	7.0	38	35										
	Su	98					6.0	7.0	34	35										
	AVG	127	1300	1550	956	32	6.3	7.1	35	34	807	336	-60	-471	706	215	-62	-491	87	64
03/09	M	119					6.0	7.1	34	35										
	Tu	129	1350	1450	930	30	6.3	7.0	36	34	614	110	-65	-504	544	91	-58	-453	89	83
	W	134	1650	1500	990	30	6.9	7.0	36	34	1030	119	-122	-911	923	89	-112	-834	90	75
	Th	142	1500	1550	920	40	6.5	7.0	36	35	860	457	-57	-403	747	320	-61	-427	87	70
	F	133	1600	1550	940	40	6.5	7.0	37	35	1039	233	-107	-806	947	167	-104	-780	91	72
	Sa	143					7.0	7.2	39	35										
	Su	139					6.5	7.2	36	35										
	AVG	134	1525	1513	945	35	6.5	7.1	36	35	886	230	-88	-656	790	167	-84	-624	89	73

REACTOR: SLUDGE BED OPERATING DATA Page 24 MONTH:SEPTEMBER 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
10/09	M	117	1400	1900	740	40	6.6	7.2	34	35	720	213	-59	-507	647	152	-58	-495	90	71
	Tu	118	1700	1850	740	40	6.9	7.2	36	35	1104	76	-121	-1028	957	56	-106	-901	87	74
	W	133	1850	1900	700	40	7.0	7.2	37	35	1135	91	-139	-1044	1025	77	-126	-948	90	85
	Th	149	1650	1950	740	40	6.8	7.2	37	35	1045	293	-112	-752	920	196	-108	-724	88	67
	F	94	1300	1800	990	40	6.1	7.1	37	35	793	511	-27	-282	707	325	-36	-382	89	64
	Sa	94					6.0	7.2	38	35										
	Su	93					6.0	7.2	35	36										
	AVG	114	1580	1880	782	40	6.5	7.2	36	35	959	237	-83	-723	851	161	-79	-690	89	68
17/09	M	94	1200	1650	1200	30	5.8	7.0	34	35	900	200	-66	-700	837	137	-66	-700	93	69
	Tu	64	1300	1600	1070	40	6.0	7.0	36	34	745	135	-39	-610	673	114	-36	-559	90	84
	W	90	1450	1550	1160	30	6.0	7.1	37	34	1080	272	-73	-808	1004	180	-74	-824	93	66
	Th	90	1200	1550	890	35	6.0	7.0	37	34	807	206		-601	700	161		-539	87	78
	F	90	1250	1500	880	25	6.0	7.0	38	35	685	96	-53	-589	615	76	-49	-539	90	79
	Sa	90					6.1	7.0	37	36										
	Su	90					6.0	7.0	27	32										
	AVG	87	1280	1570	1040	32	6.0	7.0	35	34	843	182	-57	-662	766	134	-55	-632	91	73
24/09	M	90	1450	1400	1400	25	5.7	6.9	26	33	1425	80	-121	-1345	1370	65	-117	-1305	96	81
	Tu	90	2200	1600	2070	30	5.6	6.9	33	31	1715	152	-141	-1563	1555	114	-130	-1441	91	75
	W	90	1750	1850	1360	40	6.0	7.0	35	32	1125	211	-82	-914	1035	150	-80	-885	92	71
	Th	90	1550	1950	1270	30	6.0	7.0	35	32	920	322	-54	-598	830	203	-56	-627	90	63
	F	90	1550	1900	1260	30	6.1	7.0	35	33	865	80	-71	-785	765	67	-63	-698	88	84
	Sa	90					6.0	7.0	35	33										
	Su	90					6.1	7.1	33	33										
	AVG	90	1700	1740	1472	31	5.9	7.0	33	32	1210	169	-94	-1041	1111	120	-89	-991	92	71

REACTOR: SLUDGE BED OPERATING DATA Page 25 MONTH:OCTOBER 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
01/10	M	90	850	1700	640	35	5.9	7.0	31	33	600	55		-545	557	51		-506	93	93
	Tu	90	1450	1900	1140	40	6.0	7.1	34	32	1050	151		-899	935	113		-822	89	75
	W	130	1350	1900	1180	35	6.1	6.9	34	32	905	118	-102	-787	850	98	-98	-752	94	83
	Th	190	1150	1800	890	35	6.2	6.9	35	33	703	108	-113	-595	613	88	-100	-525	87	81
	F	117	1500	1700	1010	30	6.4	6.8	35	34	903	347	-65	-556	820	247	-67	-573	91	71
	Sa	65					6.0	7.1	35	34										
	Su	60					5.8	7.0	34	34										
	AVG	106	1260	1800	972	35	6.1	7.0	34	33	832	156	-72	-676	755	119	-67	-636	91	77
08/10	M	82	1880	1350	1880	30	5.8	7.0	33	34	1326	421	-74	-905	1196	308	-72	-888	90	73
	Tu	100					6.0	7.0	33	33	920	263	-66	-657	830	203	-63	-627	90	77
	W	139	1300	1750	1030	30	6.0	7.0	34	33	875	202	-94	-673	790	160	-88	-630	90	79
	Th	136	1400	1650	1140	35	6.0	7.0	34	34	1070	252	-111	-818	955	191	-104	-764	89	76
	F	140	1300	1650	1050	35	6.0	7.0	34	34	975	299	-95	-676	875	237	-90	-638	90	79
	Sa	130		1550		30	6.0	6.9	36	31										
	Su	121					6.0	7.0	31	34										
	AVG	121	1470	1590	1275	32	6.0	7.0	34	33	1033	287	-90	-746	929	220	-86	-709	90	76
15/10	M	185	900	1400	760	25	6.0	7.0	32	32	1055	258	-148	-797	970	220	-139	-750	92	85
	Tu	205	1050	1250	820	30	6.0	6.9	33	33	1080	338	-152	-742	1020	286	-150	-734	94	85
	W	228	1000	1200	740	30	6.0	6.8	34	33	1140	395	-170	-745	1070	325	-170	-745	94	82
	Th	227	1060	1200	790	35	6.0	6.8	34	34	930	466	-105	-464	845	362	-109	-483	91	78
	F	204	1000	1250	850	30	6.0	6.8	34	34	870	630	-49	-240	815	480	-68	-335	94	76
	Sa	190	1300	1250	1150	30	6.0	7.0	34	34										
	Su	190					6.0	6.9	30	33										
	AVG	204	1052	1258	852	30	6.0	6.9	33	33	1015	417	-122	-598	944	335	-124	-609	93	80

REACTOR: SLUDGE BED OPERATING DATA Page 26 MONTH:OCT/NOV 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
22/10	M	229	750	1300	600	25	6.0	6.6	29	32	680	293	-89	-387	640	246	-90	-394	94	84
	Tu	193	1050	1200	840	30	6.1	6.6	32	32	1140	462	-131	-678	1080	364	-138	-716	95	79
	W	207	1100	1250	870	30	6.0	6.6	33	32	1005	493	-106	-512	970	365	-125	-605	97	74
	Th	169	1450	1300	1290	40	6.1	6.8	33	33	1145	733	-69	-412	1050	515	-90	-535	92	70
	F	195	1650	1500	1100	30	6.6	7.0	34	33	1170	300	-169	-870	1085	241	-164	-844	93	80
	Sa	204					6.2	7.0	34	33										
	Su	176					6.2	6.8	31	31										
	AVG	196	1200	1310	940	31	6.2	6.8	32	32	1028	456	-112	-572	965	346	-121	-619	94	76
29/10	M	220	900	1400	630	30	6.2	6.9	30	32	690	96	-131	-594	610	82	-116	-528	88	85
	Tu	89	950	1250	640	30	6.2	6.8	34	32	935	171	-68	-764	840	142	-62	-698	90	83
	W	223	1150	1250	790	30	6.3	6.7	34	33	1110	334	-173	-776	1035	259	-173	-776	93	78
	Th	218	1050	1250	690	40	6.3	6.8	35	33	965	267	-152	-698	850	214	-139	-636	88	80
	F	226	1450	1250	1030	30	6.3	6.8	35	34	1218	369	-192	-849	1075	284	-179	-791	88	77
	Sa	244					6.3	6.8	34	34										
	Su	223					6.2	6.8	31	33										
	AVG	206	1100	1280	756	32	6.3	6.8	33	33	984	247	-152	-736	882	196	-141	-686	90	79
05/11	M	258	1150	1400	910	30	6.1	6.8	30	32	1260	200	-274	-1060	1185	162	-264	-1023	94	81
	Tu	272	1150	1350	830	35	6.3	6.8	32	32	975	178	-217	-797	865	136	-199	-729	89	76
	W	267	1200	1400	980	35	6.3	6.8	33	32	870	226	-172	-644	750	176	-153	-574	86	78
	Th	259	1450	1400	1160	35	6.2	6.8	34	33	1095	698	-103	-397	960	468	-127	-492	88	67
	F	254	1500	1500	1150	35	6.3	6.8	34	33	1092	329	-193	-763	1003	249	-191	-754	92	76
	Sa	229					6.3	7.0	35	34										
	Su	245					6.3	7.0	34	34										
	AVG	255	1290	1410	1006	34	6.3	6.9	33	33	1058	326	-187	-732	953	238	-182	-714	90	73

REACTOR: SLUDGE BED OPERATING DATA Page 27 MONTH:NOV 84

DATE	DAY	FLOW	ALKAL.		V. ACIDS		pH		TEMP		SUSPENDED SOLIDS				VOLATILE SOLIDS (VSS)					
			Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Feed	Effl	Difference		Feed	Effl	Difference		Feed	Effl
		(m^3/d)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(C)	(C)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(mg/L)	(mg/L)	(Kg/d)	(mg/L)	(%VSS)	(%VSS)
12/11	M	245	850	1300	570	25	6.2	7.0	31	34	620	260	-88	-360	555	193	-89	-362	90	74
	Tu	262	950	1150	740	30	6.3	6.8	32	33	900	195	-184	-705	820	163	-172	-657	91	84
	W	251	950	1150	840	30	6.0	6.8	34	33	1005	223	-196	-782	895	183	-178	-712	89	82
	Th	242	1200	1300	950	30	6.2	6.8	34	34	1135	246	-215	-889	1010	184	-179	-826	89	75
	F	226	1200	1400	930	35	6.2	6.8	34	34	1060	170	-201	-890	965	138	-187	-827	91	81
	Sa	70					6.3	6.8	35	34										
	Su	135					6.2	6.9	33	34										
	AVG	204	1030	1260	806	30	6.2	6.8	33	34	944	219	-148	-725	849	172	-138	-677	90	79
19/11	M	260	850	1300	720	35	6.1	6.8	33	33	810	230	-151	-580	705	175	-138	-530	87	76
	Tu	270	1100	1200	1010	30	5.9	6.8	35	34	1168	243	-250	-925	1034	183	-230	-851	89	75
	W	235	1250	1300	1000	30	6.3	6.8	35	35	1095	451	-152	-644	970	321	-153	-649	89	71
	Th	220	1150	1350	840	30	6.3	6.8	34	35	915	953	8	38	805	603	-44	-202	88	63
	F	222	1100	1400	780	30	6.3	6.8	33	34	865	364	-111	-501	715	259	-101	-456	83	71
	Sa	133					6.3	7.0	34	33										
	Su	179					6.0	6.9	32	35										
	AVG	217	1090	1310	870	31	6.2	6.8	34	34	971	448	-113	-522	846	308	-117	-538	87	69
26/11	M	199	1350	1750	1090	30	6.3	6.9	30	32	1083	595	-97	-488	978	443	-106	-535	90	74
	Tu	206	1200	1650	890	30	6.2	6.9	32	32	1008	356	-134	-652	902	288	-126	-614	89	81
	W	203	1450	1600	1070	30	6.3	6.9	33	32	1227	650	-117	-577	1079	460	-126	-619	88	71
	Th	178	1400	1600	1040	30	6.3	6.9	33	33	1186	431	-135	-755	966	318	-116	-648	81	74
	F	203	1350	1650	1050	35	6.3	6.8	33	32	1132	610	-106	-522	994	470	-107	-524	88	77
	Sa																			
	Su																			
	AVG	198	1350	1650	1028	31	6.3	6.9	32	32	1127	528	-118	-599	984	396	-116	-588	87	75

APPENDIX 4

CALCULATION OF REGRESSION MODEL RESIDUALS

REACTOR: FIXED FILM

INITIAL VOID VOLUME

DATE	DAY NO	COD LOAD (Kg/m^3d)	EFFLUENT COD OBSERVED (Kg/d)	ESTIMATED (Kg/d)	RESIDUAL (Y-Y')	R^2
23/01/84	280	4.48	585.07	682.31	-97.25	0.726
30/01/84	287	5.29	671.57	880.69	-209.12	
06/02/84	294	5.79	858.42	1003.00	-144.58	
13/02/84	301	6.16	1004.37	1093.75	-89.38	
20/02/84	308	4.02	658.11	570.01	88.10	
27/02/84	315	2.57	510.30	216.80	293.50	
05/03/84	322	5.63	935.11	963.51	-28.40	
12/03/84	329	6.31	868.91	1129.89	-260.98	
19/03/84	336	7.75	1062.91	1480.86	-417.95	
26/03/84	343	4.36	643.83	653.31	-9.48	
02/04/84	350	5.25	410.26	871.50	-461.24	
09/04/84	357	5.76	691.30	994.46	-303.16	
16/04/84	364	6.16	918.61	1093.42	-174.81	
23/04/84	371	5.42	716.32	911.96	-195.64	
30/04/84	378	6.31	791.84	1128.96	-337.12	
07/05/84	385	4.94	593.23	796.06	-202.83	
14/05/84	392	4.41	541.80	666.13	-124.33	
21/05/84	399	3.67	531.22	484.89	46.32	
28/05/84	406	8.28	799.50	1611.20	-811.70	
04/06/84	413	6.39	789.45	1150.39	-360.93	
11/06/84	420	4.29	500.18	637.28	-137.10	
18/06/84	427	5.17	664.20	851.72	-187.52	
25/06/84	434	5.76	539.88	994.87	-454.99	
02/07/84	441	5.40	608.08	908.74	-300.66	
09/07/84	448	7.98	1443.02	1536.83	-93.81	
16/07/84	455	10.00	2032.22	2031.74	0.48	
23/07/84	462	10.18	2034.53	2075.00	-40.47	
30/07/84	469	9.10	2033.35	1810.36	223.00	
06/08/84	476	8.62	1684.07	1694.46	-10.39	
13/08/84	483	8.86	2069.28	1753.41	315.87	
20/08/84	490	9.60	2302.63	1934.55	368.08	
27/08/84	497	9.07	2009.47	1802.88	206.59	
03/09/84	504	7.10	1782.17	1322.64	459.53	
10/09/84	511	2.75	402.99	259.61	143.38	
17/09/84	518	4.24	553.12	623.99	-70.87	
24/09/84	525	5.44	904.89	916.38	-11.49	
01/10/84	532	5.70	773.30	980.50	-207.20	
08/10/84	539	8.73	2614.31	1721.02	893.29	
15/10/84	546	7.63	2011.66	1451.82	559.83	
22/10/84	553	6.64	1854.50	1209.97	644.53	
29/10/84	560	3.26	587.43	384.60	202.83	
05/11/84	567	3.19	767.00	367.34	399.66	
12/11/84	574	2.96	681.15	311.61	369.54	
19/11/84	581	2.34	410.67	159.30	251.37	
26/11/84	588	1.77	301.38	21.11	280.27	

REACTOR: SLUDGE BED

DATE	DAY NO	COD LOAD (Kg/m^3d)	EFFLUENT CO OBSERVED (Kg/d)	ESTIMATED (Kg/d)	RESIDUAL (Y-Y')	R^2
05/03/84	294	0.46	39.64	16.40	23.25	0.859
12/03/84	301	0.23	15.48	0.51	14.97	
19/03/84	308	1.33	43.68	78.25	-34.57	
26/03/84	315	0.77	28.44	38.21	-9.77	
02/04/84	322	0.58	20.09	24.89	-4.80	
09/04/84	329	0.24	7.46	1.20	6.26	
16/04/84	336	0.64	19.26	29.45	-10.18	
23/04/84	343	0.59	11.57	25.56	-13.99	
30/04/84	350	0.36	17.96	9.24	8.72	
07/05/84	357	0.23	15.62	-0.08	15.70	
14/05/84	364	0.14	15.32	-5.80	21.12	
18/06/84	399	1.54	85.45	92.68	-7.24	
25/06/84	406	1.45	102.44	86.36	16.09	
02/07/84	413	1.49	92.83	89.64	3.18	
09/07/84	420	1.80	84.03	111.04	-27.01	
16/07/84	427	2.12	92.46	133.99	-41.53	
23/07/84	434	1.78	97.94	109.68	-11.74	
30/07/84	441	1.91	107.37	118.64	-11.27	
06/08/84	448	2.50	184.31	160.87	23.44	
13/08/84	455	1.60	107.57	96.91	10.66	
20/08/84	462	0.89	41.96	46.78	-4.82	
27/08/84	469	1.08	59.98	60.42	-0.44	
03/09/84	476	1.16	62.93	65.84	-2.91	
10/09/84	483	0.87	41.56	45.83	-4.27	
17/09/84	490	0.79	32.71	40.17	-7.46	
24/09/84	497	1.15	34.38	65.37	-30.99	
01/10/84	504	1.11	38.18	62.69	-24.51	
08/10/84	511	1.21	63.71	69.28	-5.56	
15/10/84	518	1.87	131.77	116.13	15.64	
22/10/84	525	1.81	139.94	111.73	28.22	
29/10/84	532	1.77	101.93	109.09	-7.16	
05/11/84	539	2.29	160.07	145.68	14.38	
12/11/84	546	1.66	94.35	101.20	-6.84	
19/11/84	553	2.07	156.23	130.39	25.84	
26/11/84	560	1.94	161.04	121.44	39.60	